MODERN FLOUR MILLING

ELECTRICAL REVIEW

FOUNDED 1872

Vol. CXXVIII. No. 3300 FEBRUARY 21, 1941 SIXPENCE

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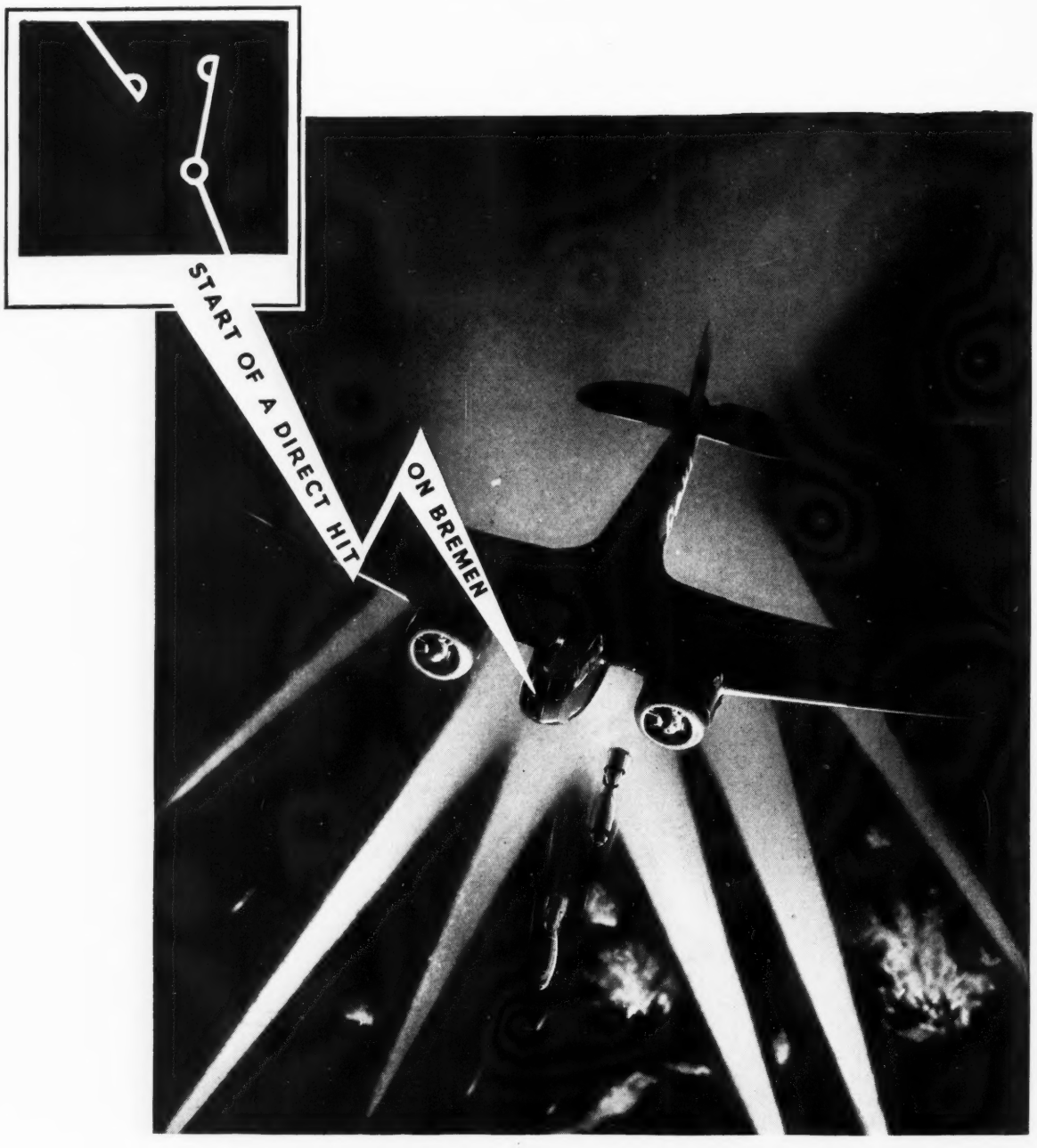

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THE ELECTRICAL REVIEW

Volume CXXVIII **No. 3300**

Friday, February 21st, 1941

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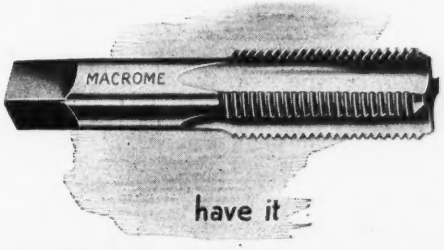

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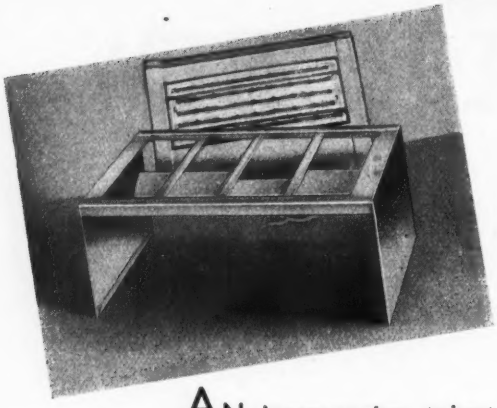

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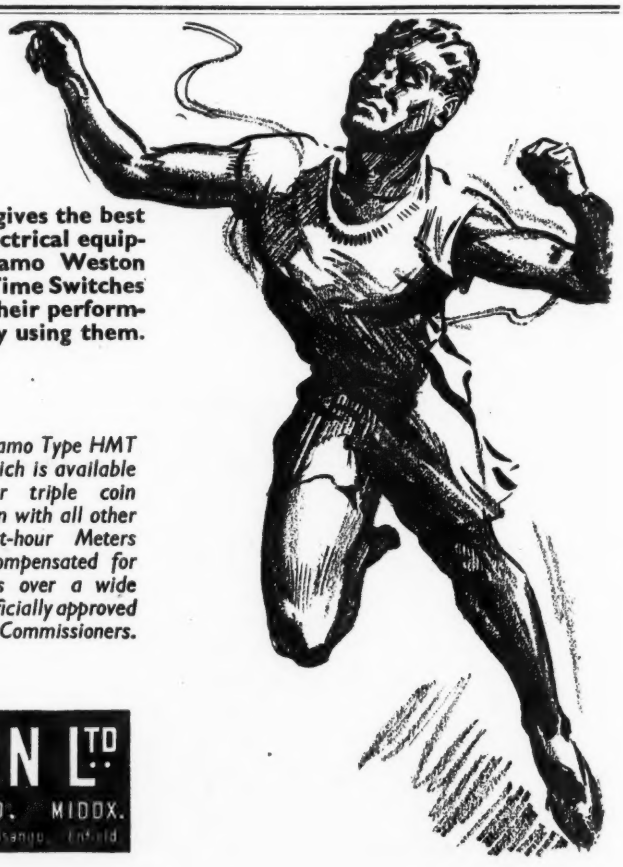

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THE
ELECTRICAL REVIEW

THE OLDEST ELECTRICAL PAPER —— ESTABLISHED 1872

Vol. CXXVIII. No. 3300 FEBRUARY 21, 1941 Price SIXPENCE

Research in Wartime

Preparing for the Future

ALTHOUGH the need to devote first thoughts to the prosecution of the war has caused electrical manufacturers to curtail their long-dated research programmes, that does not by any means imply that research as a whole is in a state of suspended animation. Actually, in certain directions, it has been immensely speeded up, though mainly with the object of serving an immediate end. That much is essential, as whatever the urgency of the moment we cannot hope to live for long on the accumulated capital of technical knowledge.

Nor, despite the distractions of the times, have the manufacturers shelved those engineering investigations that are necessary for maintaining their exports now or for fitting themselves to play their part in the restoration of national prosperity when the war is over. Yet they have had to sacrifice something in research of a more fundamental character. Fortunately, the gap can be made good to a considerable extent by the Electrical Research Association, which enjoys the tradition and retains the co-operative organisation for securing results that may be all the more fruitful because they are not evident at once. This applies also to the following of promising side-paths which may lead away from the main channel of inquiry.

Difficulties Surmounted

Subject to the paramount necessity of making the largest possible contribution towards winning the war, the Association is gallantly carrying on with and even increasing the number of its appointed tasks, under difficulties of which a depleted staff is only one. How wide a field is covered by the work of Mr. E. B. Wedmore, the Director, and his staff is made evident in the twelfth annual report of the E.R.A., which was reviewed in our issue of January 31st. Nor is that all, as the Association is centrally placed for co-ordinating available research data and for providing a connecting link between scientists and the Services and Government Departments. Tangible evidence of the recognition of its efforts is indicated by the continued financial support it receives from the Dominions and Colonies as well as from supply undertakings and manufacturers at home, and it is known to be regarded by the Government as one of the most effective bodies working under the ægis of the Department of Scientific and Industrial Research.

The tendency for electricity supply questions to absorb an increasing proportion of the Association's attention is illustrated by the subjects selected for mention by Mr. C. W. Marshall, chairman of the Council, *viz.*, circuit making and breaking, surges, interference with communication circuits and insulation. In the last-named is most apparent one function of the E.R.A., which is to relate the spheres of the physicist and the electrical engineer.

New Sectional Committees

From the standpoint of the technique of the electricity supply industry (as distinct from that of plant design), there is plenty of scope, as the Report suggests, for applying the scientific method to the study of problems of generation, distribution and sales. This aspect is exemplified in the terms of reference of two new sectional committees that have been set up to deal with electricity supply technology and with heating, cooking and allied problems. These committees will no doubt take over such investigations as those relating to voltage variation and to the economics of electric heating which are now under consideration.

A large part of research of any kind consists in checking the validity of theoretical assumptions. This has nothing to do with the old fallacy of the supposed conflict between theory and practice. The theoretical data may be incomplete or, what is more likely, in their application extraneous factors may have crept in, the effects of which have to be determined. Methods of trial and error play their part, and it is far less expensive to get these over in the laboratory stage than in the semi-finished product.

Recognition of the place of organised research in the scheme of things has been tardy, but it is now accorded freely. The ideal to be aimed at, as far as the exigencies of the hour allow, was stated in a letter

received early last year by the E.R.A. from the Government. It is that the pursuit of new knowledge should be pressed forward in wartime in order that the nation's productive and distributive machinery may be fully equipped to surmount the many obstacles that will confront it in peace.

Standard Industrial Switchgear

HITHERTO there has been no separate British Standard Specification for 400-V circuit-breakers, but the gap has now been filled as regards industrial uses by the issue of B.S.S. 936. This is none the less commendable for being a " war emergency standard," as while much research will be necessary before finality is reached, the main position is sufficiently stabilised to warrant the laying down of a definite procedure. Although B.S.S. 116, for high-voltage circuit-breakers (which had the advantage of being compiled in conjunction with the International Electro-technical Commission) has been generally applicable to lower-voltage conditions, it leaves out of account many factors influencing performance. In this issue, Mr. R. T. Lythall discusses the reasons for the differences between the two specifications, both of which should be studied as technical handbooks by all who are in any way concerned with switching.

Expediting Export

THE Board of Trade is taking steps to speed up the shipment of goods from this country. Naturally there have been serious delays in many cases but not all of these were unavoidable. Often the fault lies with the exporters themselves who have not fully acquainted themselves with the procedure and regulations governing export trade in wartime. There has, of course, also been red tape entanglement due to the too-rigid attitude of officials concerned with export, although the Board points to certain relaxations. The railways, too, have sometimes been to blame; goods have been side-tracked and have literally " missed the boat " with the secondary result of jamming at dock sheds and other port accommodation. Exporters are now urged to establish relations with the district goods officers of the railways or, if necessary, with the Board of Trade representatives on the Area Boards. The subject appears to be one upon which advice could be given to their members by the Export Groups, of whose activities little is known publicly.

Lightning

Much remains to be discovered as to what takes place when electric stress between a cloud and earth is raised to about 10 kV per cm., resulting in the phenomenon known as lightning, which is capable of producing currents (as measured) up to 100,000 A, whereas from 50 to 100 mA through the body is likely to prove fatal. Enough data is available, however, for certain practical purposes. One of these relates to the design of lightning conductors, for which the British Standards Institution is preparing a set of recommendations. In this connection Messrs. J. F. Shipley and P. E. Barnes have drawn up a memorandum summarising what is known of the subject, the greater part of which is reproduced in the *Quarterly Journal* of the Royal Meteorological Society, dated October. A second purpose for which existing knowledge serves well enough is the treatment of persons struck by lightning. This is usually artificial respiration as employed for resuscitating the apparently drowned, which has been advocated by the ELECTRICAL REVIEW for many years in cases of the more ordinary kind of electric shock.

Atomic Energy

FOR many years past prophets have warned electrical engineers to prepare for the time when the release of atomic energy would make their generating stations and transmission systems obsolete. We may, however, take comfort from the views of so experienced an authority on electricity supply matters as Mr. J. S. Dow of the Detroit Edison Co. Even if a self-propagating process, such as that set up in combustion, could be established commercially in connection with atomic-energy release, which he doubts, the problem of control appears to him to be insoluble. That probably represents the practical position within the lifetime of any of us. Nevertheless we await with interest the results of further investigations into the ability of the isotope of uranium known as U-235, to set up chain reactions which might convert atomic energy into controllable power of great magnitude.

Maintenance

AMONG industrialists the true qualifications of an electrical maintenance man are too often inadequately recognised. Indeed in some works his status is not much higher than that of a handy man. Yet to do his work properly he should have a wide knowledge of many things besides electricity, including often the principles governing the use of steam, air, water, refrigeration and machine tools and, in addition, such newer developments as electronic tubes. In a leader in *Electrical News* (Toronto) reference is made to the existence of half a dozen " electrical maintenance clubs " in Ontario, the purpose of which is to increase the efficiency of their members. The view is expressed that one result of the war will be a greater appreciation by works managements of the skill entailed in proper electrical maintenance work and its relation to rapid, continuous production. This will be all to the good, but must we wait until after the war? It is in the immediate present that those in authority should realise the need to prevent mishaps as well as the ability to put things right after the event.

Speculative Flex

IN the report of a recent meeting of the Midland Sectional Board of the Electrical Contractors' Association reference is made to co-operation with the Derby Electricity Department in an endeavour to persuade people to have their shelter wiring done by competent electricians, as it was now being done with " speculative wireless flex " by amateurs. Could this description be bettered? In the same report there appears the following cryptic passage :—" War Damage Repairs Property Scheme: A number of small orders of a few shillings value have been received."

A Live Wire

WE are often told by Parliamentary reporters that the atmosphere of the House of Commons was " electric " on this or that occasion. It seems that this may be due in large measure to the Minister of Transport, Col. Moore-Brabazon, who informed a questioner last week that he was the Minister " charged with electricity."

Modern Flour Milling

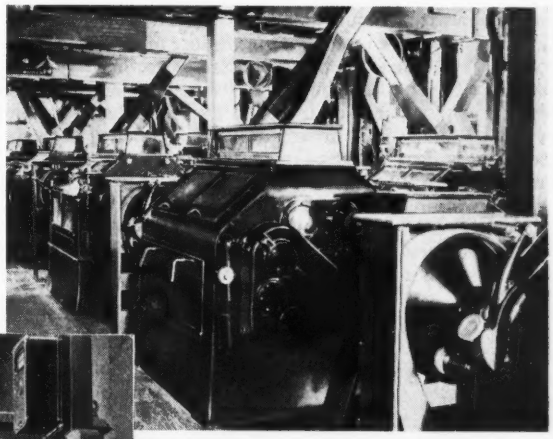
Group Driving an Essential Feature

The principal feature of the mills described is a 140-HP motor operating a series of drives in a continuous-flow system

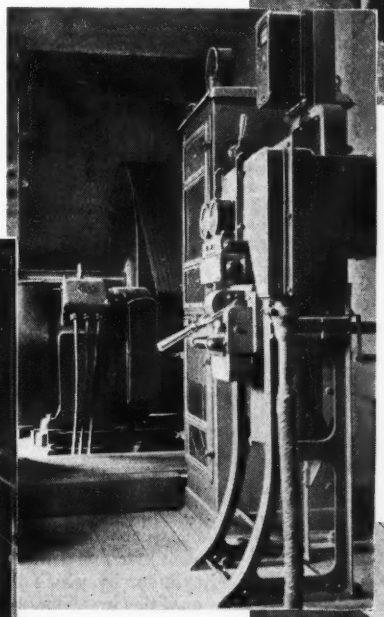
ONE of the strongest cases for the group driving of industrial machinery is presented by modern flour milling as we saw it recently in the mills of E. Caudwell, Ltd., where the complete grinding plant of the present installation, which has an output of ten sacks of flour per hour, may be regarded as just one automatic machine driven by a 140-HP motor common to the many processes of grinding and grading, all of which are arranged on the sequence-process and continuous-flow principle, the successful functioning of each process depending on the correct results of the preceding stage.

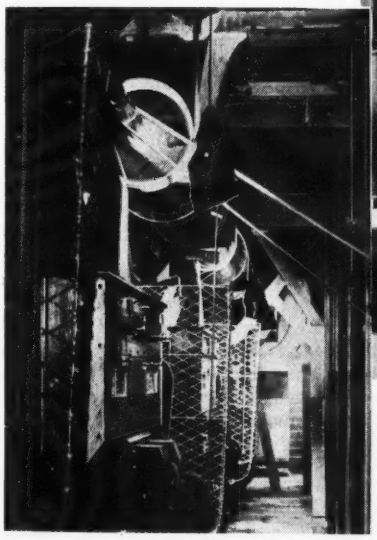
Under the guidance of Mr. W. Jones, the mill manager, we saw the two essential installations at the mills, namely, the intake and cleaning plant and the grinding plant, and we think the best understanding of the electrical applications in the various processes and of the operation of the plant as a whole will be obtained by following the stock (wheat) through the mills from its reception in the raw state to its despatch as flour.

It may first, however, be worth recording that the modern note which is traceable throughout the whole equipment is not the result of a new business venture, but rather of a policy of almost continuous reconstruction to keep the production abreast of development. Flour mills have stood on the same site for centuries and the existing premises date back to 1894. Since then, in addition to increases in the capacity of the plant, the mills have seen, progressively, several conversions from the earlier steam driving to the present modern form of electric driving.

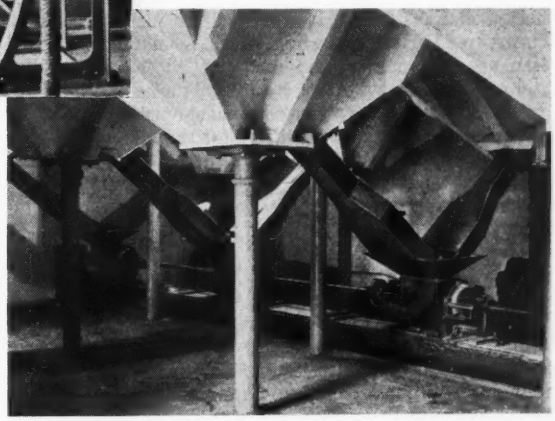


A section of the rolling (grinding) floor





The many grinding processes are achieved with a 140-HP motor. Left: A section of the purifiers for gradual reduction and grading. Right: Wheat measurer-mixers and worm conveyors feeding the cleaning plant driven by 2-HP motor



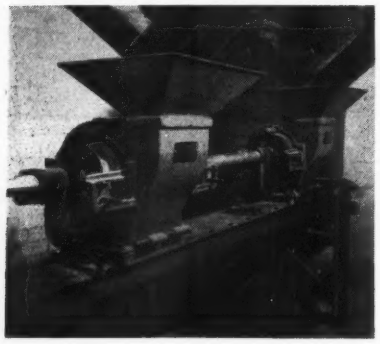
Received by both road and rail, wheat is first delivered into a hopper below ground level by a chute at the side of the building and then a bucket elevator takes it to the third floor of the section of the premises housing the intake and cleaning plant, where it is treated in a rubble machine in which such foreign matter as stones and pieces of metal are removed on the sieving principle by a travelling endless wire mesh through which the corn passes. The stock is then further elevated and distributed by worm conveyors into silos. From these it falls into measurer-mixers in each of which there are receiving pockets on a slowly revolving drum. The size of these pockets in relation to the areas presented to the delivery apertures of the silo chutes can be varied so that the rate of delivery from the different silo chutes is adjusted. A 12-HP motor serves the whole of the intake plant which will deal with 20 tons of wheat per hour. It has a simple V-belt drive on to a line shaft from which the various elevators and conveyors are served by flat belts.

Under the line of measurer-mixers is a worm conveyor (driven with the mixers by a 2-HP motor) which receives the wheat and delivers it to the cleaning plant in which it is separated and aspirated by means of a series of agitated grading screens, the dust

being drawn away by a fan. After this preliminary cleaning further separations are carried out in two Carter disc machines, the first removing barley and oats and the second removing cockle and small seeds. Each of these machines operates on the gradual-separation principle by means of a series of discs which revolve vertically on a common shaft in a trough housing. In the vertical surfaces of the discs are cups which continuously pick out the desired sizes of seed or cereal from the stock in the trough and gradually deliver it horizontally through the machine.

The next process, scouring, is effected in machines in which arms travel at a high speed and beat the wheat against the emery lining of the machine casing. A Mumford washer next deals with the wheat which is mixed with water in a trough in which a worm conveyor carries the wheat and water into the " whizzer " component of the machine in which impurities are passed through the perforations in the wall of a revolving container under centrifugal action. The remaining wheat is directed to the top of the container to a feeding chute which serves the conditioning plant, a long vertical affair extending through three floors of the premises and through which the wheat passes to receive progressively various conditioning treatments, which include warming and drying.

The whole of the wheat-cleaning plant has a common group drive from a 45-HP, 485-RPM, slip-ring motor served by a Brookhirst contactor starter with a primary V-belt 3 to 1 speed reduction transmission to a countershaft from which there are simple flat-belt transmissions to the various components of the plant referred to. A 2-HP motor drives the mixer, the elevators and the feed to the mills. With a speed of 940-RPM this motor transmits first through a simple 7 to 1 reduction gearing and then by belt to the pulleys of the various machinery components.

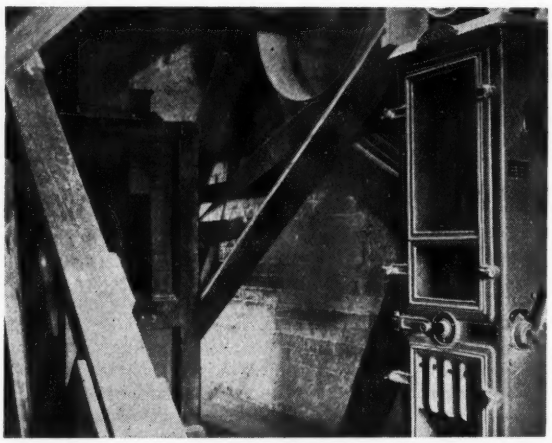


The 2-HP motor-driven mixers and worm conveyors in the production line work in sequence with the similar equipment serving the cleaning plant

After conditioning and a subsequent laying-up period in silos necessary for the correct mixing of the wheat which is effected in a machine driven by a 2-HP motor, the stock is conveyed to an aspirating brush machine for a final clean up. The mixers and conveyors in the process line after conditioning are driven by a 2-HP motor and the drive for this mixing and conveying equipment operates essentially in sequence with the similar drive for the mixers and conveyor feeding the cleaning plant, although the two motors are started separately.

The aspirating brush machine constitutes the first component of the grinding section of the mills and is situated on the fourth floor. In it there is a perforated cylinder through which all the light beeswing of the grain is passed by means of a high-speed brush. After automatic weighing, the stock is passed to the first-break machine in which the 50-in. by 10-in. rolls just crack up the wheat ready for delivery to the plan sifter for grading into four divisions, from coarse to fine. This chest-like equipment has a flexible suspension from the ceiling structure by a number of cane rods at each of four suspension points, and a peculiar circular agitating motion is imparted to it by a weight swung round within a race bearing from the bottom of a vertical driving-shaft carried solely by an overhead bearing at the driving point.

There are suitable flexible fabric communications for delivery to and from the chamber of this sifter in which there are four series of grading sieves in tier formation. The four grades of stock pass down to appropriate purifiers,



A 45-HP group drive for the whole of the wheat cleaning plant; the illustration shows the scourer, motor starter and transmission arrangements

many of which are housed on the second and third floors, but the whole should be regarded as one complete installation operating on the principle of gradual reduction and grading, the product of one machine passing for treatment to another machine.

Except for the degree of grading permitted all these machines work on the same principle. A sheet of silk held taut in a suitable frame which is agitated by an eccentric at one end of the machine forms the grading medium, the stock travelling along the silk from one end of the machine to the other and the fines passing through the appropriate grading stages, while the coarser material is kept at the top of the layer of stock as the result of the agitation.

From the purifiers the stock is passed down to the grinding machines proper on the first floor. These grinders vary in roller size from 40 in. by 10 in. to 20 in. by 10 in. and in the roller setting for grinding, and, as in the case of the purifying machines, the whole can be regarded as one installation operating on the gradual-reduction principle by which the product of one machine is the " raw material " for the next. The ground stock is finally treated in centrifugal dressers in which the flour is graded out on a reduction system, each machine containing a horizontal silk covered revolving cylinder by which the stock is separated into the required qualities for the market. An essential feature of the milling plant is the extensive system of elevators and conveyors interlinking the various components of the plant, designed to ensure uniformity of feeding of the stock throughout the equipment.

The Main Motor

The whole of the grinding plant from the aspirating brush machine to the dressing machines, all of which is distributed over the four floors of the building, is driven from the 140-HP Lancashire Dynamo slip-ring motor on the first floor. It is a pipe-ventilated machine which runs at a constant speed and is controlled by a Brookhirst contactor starting panel governed by an oil circuit-breaker. From the motor pulley there is a ten-" Texrope " transmission to a main shaft at the ground floor with an actual speed reduction ratio of 750 to 190-RPM. From a pulley on this ground-floor shaft there is a rope drive to a line shaft to

each of the floors above and, with the exception of the top-floor shaft, which has a speed of 130 RPM, all these transmissions are of even ratio. From each of the four floor line shafts there are simple belt transmissions to the individual machine shafts, with varying reductions to suit the machine processes, but with an average ratio of about 3 to 1. To facilitate the starting-up of this big group drive two of the floor line shaft transmissions are taken first through friction clutches at the ground floor.

The bulk of the flour from the grinders is chute fed into bags and weighed off ready for dispatch by lorries, but a small quantity of the flour is conveyed to a small bagging plant, driven by a 0.5-HP motor, in which it is automatically weighed and bagged. Associated with this small bagging machine there is a travelling bag-sewing machine with a ½-HP motor drive to deal with the filled bags. This plant as a whole will handle up to 20 bags per minute.

A useful piece of equipment handed down from one of the earlier installations is a small water turbine operated from a fall in the stream on which the mill is built. From the upward projected vertical shaft of this turbine there is a belt transmission to an intermediate shaft which has a further belt transmission to or from the main mill motor shaft. From the immediate shaft there are further belt transmissions to an oat roller and grinder whose operation is the primary concern of the water turbine, but in times of low water these machines can be driven from the main motor by the intermediate shaft, or, conversely, the main mill drive may be helped by the water turbine through the same medium.

The electricity supply is taken from the 11,000-V system of the Derbyshire & Nottinghamshire Electric Power Co., and in a substation on site a transformer is served by simple truck-type e.h.v. switchgear and delivers at 440 V to an oil circuit-breaker switchboard from which the mill is fed. Neat and simple ironclad switch and fuse distribution gear in the mill controls the various power and lighting circuits.

We are indebted to Mr. C. G. Caudwell, J.P., managing director, for permission to visit the mills and to take photographs and to Mr. W. Jones for his help in collecting the above information.

Mysterious Fires

Possible Effects of Earth-Fault Currents

By P. Ridler

ONE of the oldest and most elementary wiring regulations requires an electrical installation to be separated by spacing, or insulation or other means, from earthed pipes. The importance of this cannot be over-emphasised. If, for example, a steel conduit is touching a composition gas pipe when a fault to earth occurs, the momentary rise in potential of the conduit, and hence difference in potential between it and the gas pipe, may be sufficient to pass a current which will burn through the pipe and ignite the escaping gas—at first possibly through only a pin-hole.

After investigating the origin of a number of fires I am convinced that where these have been due to gas pipes in fortuitous contact with the metal covering of cables, the fault current which produced the p.d. often has not originated on the affected premises, but quite possibly a considerable distance away. The fault current, in finding its way back to the substation earth-plate will, of course, follow the path of least resistance.

The occurrence of fires at points remote from the cause has been found to be due to the contact of gaspipes and conduits and to inadequate earthing arrangements

Three paths for this current, in towns at least, are water pipes, gas pipes and electric cable sheaths, and a fault current may follow any, or all of them. Thus there might easily be a p.d. between one system and another, *e.g.*, between gas system and water system, or gas system and service cable sheathing.

Illustrative of this is one case in which it appears probable that failure of insulation in a main switch on one premises, A, which was sufficient to blow a 60-A service fuse, produced p.d.'s between these systems sufficient to puncture and fire a gas pipe in another premises, B. The main switchgear at A was earthed to a water pipe, as was the conduit system, which also made contact with the steel frame and thence with a gas pipe. Positive evidence was destroyed by the fire, but there was ample indication that a composition gas pipe, an unarmoured lead-covered service cable and an earthed steel conduit had all been in close proximity, probably touching at B. Possibly the service cable sheath, which was jointed to a distributor in an earthenware duct, remained at earth potential, and the potential of the gas system was raised sufficiently to cause it to be punctured at its point of contact with the lead covering of the service cable.

More striking still is the following instance in which a gas pipe was fixed at its point of contact with a *water* pipe. A heavy fault to earth had occurred, *via* the metal covering of an installation, to the water system, in a terrace house. A few minutes later a gas pipe was discovered on fire in a house two doors away.

The electrical installation there, also metal sheathed, was found well separated from the gas system, and was satisfactorily earthed to the water system, but at the seat of the fire it was evident that a gas pipe had been touching a water pipe. The soil in the district is of a rocky nature, one not likely to dissipate a fault current rapidly. When the fault occurred, the water system in that area would rise above earth potential, and therefore above the potential of the gas system. This, I think, was sufficient to puncture and fire the gas pipe.

In another instance an electrician accidentally touched a gas pipe with a live conductor when attending to a repair. No damage was done at the point of contact, but fire broke out over 40 yards away, where the gas pipe was touching a patch of damp plaster. A further case of this kind occurred in a large block of flats built to form an open rectangle. The building was steel framed with reinforced concrete floors. At 2 a.m., shortly after an air-raid warning, the occupiers of a flat were alarmed by what they imagined to be an incendiary bomb in their scullery. Brilliant arcing and spluttering was taking place on the ceiling, and molten metal dropped from a hole there on to clothing hung below. This caught fire and added to the "bomb" effect.

The hole in the ceiling led into a conduit which ran across it, concealed by a skimming of plaster. The circuit in this conduit was protected by a 5-A fuse which had blown, and clearly could not have passed sufficient current to cause such damage. Further examination showed that a fault to earth had developed on a main switch in a heavily-fused circuit in another flat in a distant part of the building.

The earth wire was of insufficient size and had burnt clear. The main switch and conduit installation were in contact with the frame of the building, resulting in the whole frame becoming charged. Each flat's installation has its own earth connection, and the conduit in the first-mentioned flat was in contact with some part of the floor reinforcement. This formed a path to earth for the current from the faulty main switch until it also burnt clear, melting about 1 in. of steel conduit. The whole of the building then remained alive until the faulty section was isolated.

These instances show that there is good reason for isolating gas pipes, particularly those of soft composition from both electricity and water systems; also for earthing the frames of buildings, and for preventing as far as possible any rise of potential of metal coverings.

PERSONAL and SOCIAL

News of Men and Women of the Industry

THE latest supplement to the *London Gazette* announces awards for gallantry during air raids to a number of Post Office employees. The George Medal is awarded to **Mr. Gilbert J. S. Little**, A.M.I.E.E., chief regional engineer, Manchester; **Mr. Gilbert J. Griffiths**, assistant engineer, Coventry, and **Mr. Kenneth G. Giblett**, unestablished skilled workman, Bristol. The British Empire Medal is awarded to **Messrs. A. R. Ashley**, skilled workman, Class I, Bristol; **A. Whiteley**, regional headquarters inspector, Manchester; and **E. Long**, skilled workman, Class I, Manchester.

Mr. G. H. Sammons, well known in electrical circles in the North, just appointed chief engineer and manager of the electricity undertaking at Dewsbury, has been deputy engineer and manager at Blackburn during the last three and a half years, which have been marked by great developments and expansion. He succeeded Mr. A. Latham, who has become engineer and manager of the electricity undertaking at Mansfield. Mr. Sammons, who is forty-four, received his early education at the Birmingham Technical College. Prior to service in the last war he joined the staff of Veritys, Ltd., of Aston; he was then with the G.E.C. for a time and later was in the test room of the Birmingham undertaking to which he returned on his demobilisation.

Mr. G. H. Sammons

He was promoted mains assistant in 1922, and moved to Wolverhampton as testing engineer the following year. Here he took up the duties of assistant distribution superintendent in 1928 and afterwards became engineering and distribution superintendent at Hampstead in 1930. A year later he was appointed sectional mains superintendent in the Manchester undertaking, and after three years went to Grimsby. He is an associate member of the I.E.E. and was elected to the committee of the North-Western Centre in 1938.

Mr. L. M. Tye has left Holophane, Ltd., with whom he has been associated for thirty years, to take up the position of illuminating engineer with Bell Bros. & Co. (London), Ltd., electrical contractors. Mr. Tye has specialised in power station, industrial and street lighting, and has been associated with many of the largest schemes of these types in this country.

A plea for better houses after the war, houses that would be healthier, more convenient and easier to run, was made by **Miss Caroline Haslett**, director of the Electrical Association for Women, at a lunch held by the Association's London Branch at the Criterion Restaurant, Piccadilly, last week. Miss Haslett said that in the course of her work in connection with the Ministry of Labour, visiting engineering training establishments, she was astonished at the way women were learning to use tools. The knowledge and experience gained by them would make them much more "machine minded" and anxious to employ labour-saving devices in the home.

Mr. George Hicks, Parliamentary Secretary to the Ministry of Works and Buildings, who was the principal speaker at the lunch, said that there were a great many ways in which electricity could be utilised in the home and at the Ministry they were inquiring into all ways in which the homes of the future could be made better and more beautiful. Many improvements were incorporated in the four million houses built after the last war but there was still need for further progress. The Minister thought that houses had hitherto been built too much round the kitchen and that the utility side of the house should be kept more apart. The Ministry was working on the lines of standardised units without standardised design.

Mrs. C. Deave, chairman of the South-East London Branch, urged that women should be allowed to have a considerable share in the replanning of future homes.

The Great Yarmouth Corporation Transport Committee has agreed to pay **Mr. F. W. Sharman** £350 per annum during the time he is acting as general manager of the undertaking.

Mr. R. C. Henniker, B.Sc., A.M.I.E.E., has joined the British Power Transformer Co., Ltd., Ponders End, as manager. Mr. Henniker has during the last 4½ years been engaged on transformer design with Johnson & Phillips, Ltd., and was previously with Bruce Peebles & Co., Ltd., and the Metropolitan-Vickers Electrical Co., Ltd.

Mr. H. Anderson has been appointed meter superintendent to the Stalybridge, etc., Transport & Electricity Joint Board. Mr. Anderson was previously with Ealing Corporation.

Bradford City Council has confirmed the appointment of **Mr. W. Dundas**, deputy electrical engineer, to the post of electrical engineer in succession to the late Mr. Thomas Roles, at a salary of £1,500 rising to £1,750 per annum.

Mr. R. G. Chinn, who has been sales manager of Mortimer Gall & Co., Ltd., for the past six years, has been elected to the board of directors.

Mr. N. N. Lucas has been appointed secretary *pro tem.* of the Wireless Retailers' Association in succession to the late Mr. M. E. Cavendish. For the duration of the war the office of the Association will be transferred from London to Manchester. Mr. Lucas is secretary of the Manchester branch of the Electrical Contractors' Association.

Mr. B. S. Woodfull, city electrical engineer of Melbourne, has been elected president of the Electricity Supply Association of Australia and **Mr. V. J. F. Brain**, chief electrical engineer of the N.S.W. Department of Works, has been elected vice-president.

Mr. L. H. Marlor, installations engineer with the Manchester Corporation Electricity Department, who recently retired on superannuation after nearly forty years' service, has received presentations from his colleagues. At a recent gathering Mr. H. C. Lamb, chief electrical engineer, handed to Mr. Marlor a portable typewriter and a fountain pen.

Mr. R. F. Hatto, a director, and for the past nine years sales manager, of S. Wolf & Sons, Ltd., Pioneer Works, Hanger Lane, Ealing, W.5, has been appointed general manager of the company. Mr. Hatto has been connected with the company for over twenty years.

Mr. A. Burton, of Warrington, has been appointed assistant mechanical superintendent at the Croydon power station, and **Mr. W. Phethean**, of Norwich, as assistant distribution engineer.

Mr. H. R. Beasant (chairman) presided at a luncheon held at the Berkeley Café, Clifton, Bristol, on February 10th, by the Western Centre of the Institution of Electrical Engineers. The Lord Mayor (Alderman T. H. J. Underdown) spoke of the re-planning of Bristol. He said that there was every desire to take up trading again, especially in the areas that had been terribly bombed.

The chairman, proposing "The City and County of Bristol," said that the damage caused by enemy raids on Bristol was not all on the debit side. There had been a certain amount of clearing away of inconveniences that could well be done without. He referred appreciatively to the presence of Alderman A. A. Senington (chairman, Bristol Electrical Committee), Mrs. Senington and Alderman and Mrs. Long of Bath.

Alderman Senington proposed "The Institution of Electrical Engineers" and the President, Mr. J. R. Beard, in replying, referred to the hard work that was being done in keeping this vital service to the community going in very difficult times. He said that the grid system had shown the importance in wartime of pooling electrical resources.

Mr. Price F. White has been nominated to a vacancy on the Bangor Town Council, created by the absence of his son, **Major D. A. Price White**, who is on active service.

Mr. H. C. Beck has been appointed personal assistant to the chief electrical engineer, Southern Railway.

Obituary

Mr. H. Fletcher.—We regret to hear from the General Electric Co., Ltd., of the death, on February 2nd, of Mr. Henry Fletcher, the chief accountant at the company's Witton Works, a few days after he had collapsed in his office. Mr. Fletcher went to Witton thirty-nine years ago as chief clerk at the Carbon Works. He was soon transferred to the engineering side to take charge of the general office, and he was promoted to the position of chief accountant in 1918. During his long years of service he played a most active and invaluable part in the rapid expansion of the Witton factories. In addition to his normal activities he took a keen interest in the company's pension fund from its inception.

Mr. A. Hall.—We learn with regret of the death, on February 11th, following a road accident, of Mr. Albert Hall, chief radio engineer of Ferranti, Ltd.

Mr. W. S. Sprague, whose death occurred on February 9th, at the age of sixty-six, was actively engaged with Chamberlain & Hookham, Ltd., for forty years. He retired from the position of managing director four years ago, retaining a seat on the board. He took a great interest in B.E.A.M.A. and other associations connected with the electrical industry, and was at the time of his death chairman of the Meter Section of B.E.A.M.A., a position which he had held for a considerable number of years.

Mr. Francis Archibald, whose death has occurred at the age of fifty-three, was senior charge engineer at the Dalmarnock power station of Glasgow Corporation. He had been in the service of the Corporation Electricity Department for nearly thirty years.

Wills.—Mr. Thomas Roles, M.I.E.E., late city electrical engineer and manager at Bradford, left £5,054 with net personalty £4,825.

The late **Sir Robert Hadfield, Bt.**, left estate valued at £42 0,696 (net personalty £184,029).

Lower-Voltage Circuit-Breakers

A Review of B.S.S.936/1940

By R. T. Lythall, A.M.I.E.E.

The author deals with a new specification for industrial switchgear for up to 660 V which is the first attempt to set up a standard solely for this class of gear

WHEN, in 1937, B.S.S.116 was issued in its revised and present edition, it was appreciated that, valuable as it was, it omitted a very considerable range of oil circuit-breakers, namely, those for use on system voltages below 1,000. This was noted in the foreword. Nowhere was the need for a further specification realised more than among designers whose job it was to assign a breaking capacity with a sense of responsibility. Designers and users alike understood that 25 to 30 MVA at 400 V meant more than was at first apparent, when considered in terms of breaking current.

As the production of a specification to meet such conditions entailed consideration of other factors arising in lower-voltage* networks which differed from those covered by B.S.S.116/1937, it was soon appreciated that, in spite of the work put into the latter and the experience gained since its issue, considerable thought must be given to the subject.

Lower-voltage circuit-breakers may be divided into two classes. In the first class are those which may be used on systems where the fault conditions may be as severe as those envisaged in B.S.S.116 for the higher voltages, e.g. lower-voltage power stations and power station auxiliaries. The second class, by far the largest, may be taken as including the many thousands of circuit-breakers which can be correctly termed "industrial." B.S.S.936/1940, now issued as a War Emergency Standard,"† covers the second class. It is issued as such with a full knowledge that after the war certain modifications may be necessary, but which, at the moment, cannot be considered as fully as desired owing to the war.

The urgent need for a specification, however, will be satisfied by the present method. That it covers the second group of circuit-breakers is indicated by the words used under the heading "Scope":—". . . which are intended for use in those electrically remote parts of the system where marked asymmetry in the short-circuit current cannot occur, and where the restriking conditions are not severe."

Mr. Lythall is manager of the Switchgear and Transformer Departments of Johnson & Phillips, Ltd.

An examination of the new specification soon reveals considerable similarity with B.S.S.116. Many clauses are repeated without change so that a review of the new issue demands reference only to the changed or new clauses. Chief among the changes under "Definitions" is that which introduces a "force trip" release, which is a safeguarding device developed by designers against possible disaster when closing a circuit-breaker on to an existing fault. It measures two opposing forces: that exerted by the operator in his efforts to close and that produced by the fault current. When the latter exceeds the former, the circuit-breaker is tripped out automatically.

Equally important are new definitions which introduce prospective values of current. A high-rupturing-capacity fuse "cuts off" at some value of current less than the maximum value which can appear on the system under fault. This is already covered in B.S.S.88 (Electric Fuses) and the fuse is credited with a breaking capacity equal to the maximum and not the "cut-off" value. Now similar clauses appear in a specification for oil circuit-breakers, as it has been proved that in certain types similar characteristics are in evidence. This is the case with "force-trips" and to some degree with series (whole-current) overload trips, particularly in the lower normal current ratings where the impedance of the coil is high. It occurs also when back-up fuses are used with circuit-breakers.

As in B.S.S.116, efforts have been made to reduce the number of standard normal-current ratings; but in a well-established and standardised line, difficulties arise in eliminating too many, desirable as this may appear on the surface.

Rated making current must not be less than the rated breaking capacity, in amperes, multiplied by the factors 1.4 and 1.414, *i.e.*, by 2.0. This contrasts with the factor 2.55 in B.S.S.116, and represents an easement in making duty which is warranted by a reduction in the asymmetry factor appropriate to the power factor of low-voltage circuits under fault conditions. In high-voltage circuits, resistance plays a relatively small part in limiting fault current. On the other hand, the opposite is true in most low-voltage networks of the type envisaged in "Scope," and resistance has considerable value in relation to reactance. As the ratio R/X approaches unity, so the asymmetry factor similarly approaches unity.‡

Hence with higher power factor, the peak current on making is reduced and, in consequence, the severity of duty imposed on the circuit-breaker. The value 1.4 (as opposed to 1.8 in B.S.S.116) represents a power factor of 0.3. This allowance may yet lead to discussion on the ground that one school of thought considers 0.5 a more reasonable value.

Eight recognised ratings of breaking capacity from 0.5 MVA to 30 MVA, at 400 V are set out in Tables 3 and 4. Coupled with these ratings is a series of standard normal-current ratings. The value of 0.5 MVA envisages those small breakers of 30 to 60 A. It should be noted that at the highest value, 30 MVA, the minimum normal current rating is 600 A. This answers the many queries as to why, when the user has specified 60-A breakers at 30 MVA, he has been offered 600-A units.

It is of first importance to note that the highest breaking capacity recognised is that corresponding to 44,000 A, which is the same as in B.S.S.116. The reasons for this limit are now fully appreciated, particularly as it represents a making current (peak) of some 88,000 A. The duty cycle in the new specification is B–MB as against B–MB–MB in B.S.S.116. This shows an easement which is justified.

Under the headings of "breaking and making currents," clauses are introduced to indicate clearly the conditions under which the prospective current shall be determined as a measure of the circuit-breaker rating. Since higher values of short-circuit power-factor may be allowable in lower-voltage work, a figure of 0.3 lagging has been specified as against 0.15. Possibly 0.3 may be thought too low, but, at this value, a factor of safety is introduced for the majority of circuit-breakers, which, as indicated, are at "electrically remote parts of the system."

In B.S.S.116, standard type-tests consist of a series of five test duties at values of 10, 30, 60 and 100 per cent. of rating. Recognising a need for easement (and testing costs) in regard to the lower-voltage breaker, the new specification requires two test duties only, one at 30 per cent. and one at 100 per cent. of the rated breaking capacity. Both tests must be to the duty cycle B–MB. Some criticism may arise because of the inclusion of the 30-per-cent. cycle, but testing experience is that many circuit-breakers which perform satisfactorily at full rating often display considerable distress at some value between 25 and 35 per cent. It is noted that no asymmetrical test is required.

Users of switchgear should note the information included in Appendix K regarding the calculation of short-circuit currents. This Appendix is, in itself, a useful commentary on the methods and precautions to be taken in ascertaining the values of fault current. It is extended beyond the information given in the equivalent Appendix in B.S.S.116 because many important factors arise in lower-voltage calculations which are not so important at the higher voltages. It has been considered wise, therefore, to give ample guidance to users to enable them to determine

* In this review "lower voltage" means up to, and including, 660 V.

† Published by the British Standards Institution, 3s. 6d. net.

‡ See ELECTRICAL REVIEW, May 26th, 1939, "Short-Circuit Power Factor," by O. J. O. Garrard.

more accurately the worst they may expect on any particular system. Many examples are included, together with a comprehensive illustration designed to show how, on a complicated network, the fault value at a given point may be easily calculated by means of reduction diagrams.

A table is included to show the reactance due to bare copper connections, a selection of the more usual sections being given.* Attention is drawn to the need for inclusion in any calculation of the equivalent reactance of the higher-voltage network which feeds the lower-voltage network. Examples indicate the easement in short-circuit values due to this reactance.

Stress is laid on the importance of resistance, while further notes draw attention to the vital need for properly planned layouts to limit suitably the value of fault current. A short table of recommended limits of plant capacity to be connected to any one section of busbar is also given. It should be noted that these are maximum total values and that 2,000 kVA, for example, may be in one unit of that capacity or two units of 1,000 kVA, or four units of 500 kVA. This Appendix can be of greatest value to the user, as in condensed form it includes much valuable material.

Selection of ratings for load and short-circuit conditions are among a number of headings in Appendix L. There are new and significant paragraphs, the intention of which is to indicate that it is unreasonable of the user to expect tests at each and all of the many slightly variant voltages which occur in service.

*For an extended table and a more rational formula reducing the number of decimal places, see ELECTRICAL REVIEW, January 27th, 1939, "Low-Voltage Short-Circuit Values," by R. T. Lythall.

Thus, while 400 to 450 V may be regarded as a modern standard, many networks do exist where slightly different values obtain, *e.g.*, 380 V. A user should not expect a manufacturer who has proved his designs at 400 V (or even 600) to do so at 380 V or other minor variation. A new paragraph states that "a circuit-breaker having a symmetrical breaking current rating at a particular rated service voltage is suitable for the same rated symmetrical breaking current at a lower service voltage." It is rightly noted that when expressed in terms of MVA, the second is lower than the first. It gives point to the need for thinking in terms of breaking current rather than MVA, a point stressed both in B.S.S.116 and B.S.S.936. It means that if the fault value on a user's network is determined as "X" amperes, then the maker is right in offering a breaker proved capable of interrupting this value of current even though the proving test may have been at a higher voltage than the user's system voltage.

The foregoing reviews the new specification in its major details only. Its issue fills a gap in our range of standard specifications, and its appearance, though affected by war conditions, comes at a time when knowledge of the problems is such as to make the specification most valuable. Had it been issued two or three years ago, its value would have been considerably less. It will, naturally, be some time before all lower-voltage circuit breakers can be proved to the specification. This applied equally when B.S.S.116 appeared, but the latter is now almost completely recognised for all higher-voltage breakers. Thus it will be for B.S.S.936 in a year or two.

Applying Research

DURING the course of his address as chairman of the Council at the annual general meeting of the British and Allied Industries Research Association on February 14th, Mr. C. W. Marshall discussed the important problem of securing proper utilisation of the results of researches, which he regarded as now the most outstanding general objective of the Association. Inquiries which he had made had indicated a demand for summarised reports, as many members found themselves unable to absorb all the information they received. Under the present system every report contained a preface setting out its status and intended utility and, unless it was quite short, a summary including (where practicable) a short statement of its conclusions. It had been proposed that the appropriate committees should also issue shorter reports, limiting the full reports to experts.

As an example of the procedure for enabling the industry to keep its ideas up-to-date, Mr. Marshall cited the Cable Rating Handbook, which was the result of investigations covering more than twenty years, during which time progress reports were issued enabling substantial economies to be effected. The presentation of reports through the Institution of Electrical Engineers in the form of papers had proved valuable.

Building up Effective Reports

Factors in the building up of an effective research report were, first, the preparation of a critical résumé of available information, and secondly, a short statement of the objects intended to be achieved. Each proposal was initially studied by an executive committee of users' representatives and investigators, thus providing an opportunity for co-ordination at a critical period. The third stage was the scrutiny of the preliminary report by the same executive committee, which then submitted a draft to the sectional committee representing all the interests concerned. The report was then recommended to the Council for issue.

As a fourth factor there was a standing order that a committee should not remove the subject of any research from its agenda until the objective had been attained. It might take many years for the results of research to be assimilated by the industry and it should be the duty of the committee to nurse these results towards maturity. New ways of accelerating this assimilation would be devised. More effective co-ordination was necessary between research and engineering than could be provided by a written report and, as a fifth factor, members' technical representatives were invited to confer directly with the authors of the report.

The Association's bureau of technical information was able to produce data to which individual members had otherwise no ready means of access. The records were being extended to cover as far as practicable everything of value in every past, present and future E.R.A. report.

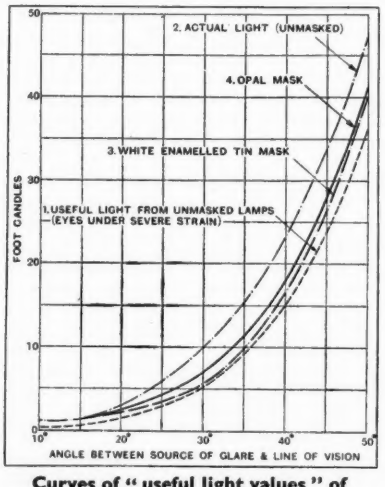
The income of the Association was now £80,000 per annum, but ten times that amount would, he believed, be a not unreasonable aim. In order to achieve this, members must not only get good value for their money, as indeed the work of Mr. E. B. Wedmore and his staff ensured, but they must be made continuously aware of the fact. One way of doing this would be by the proposed issue of a stream of technical booklets recording the concrete achievements of the Association.

Correspondence

Every letter must be accompanied by the writer's name and address preferably, but not necessarily, for publication.
The Editors cannot accept responsibility for correspondents' opinions.

Factory Lighting

After reading the article on "Lighting in Factories" in your issue of October 25th last, I got to work with the idea of devising a form of screen which would meet the requirements of the Fifth Report of the Departmental Committee on Factory Lighting. The figures given by "Lighter" in his illustration of the high cost of glare have proved most helpful to me in experiments designed to cure "obstructive glare." I have included in the accompanying graph a curve showing the "useful light values" from an unscreened lamp of the same size as that used with the screens for which I have set down the light curves. I have also shown the actual light curve (unscreened). The criticisms of your readers would be welcome.



Curves of "useful light values" of screened and unscreened lamps

Barrow-in-Furness, *Feb. 12th.* ROBERT CALDWELL.

Logic or Expediency?

Maximum Demand and the Small Power Consumer

By D. J. Bolton, M.Sc., M.I.E.E.

The annual load factor is not a single entity but is made up of a number of components. This article describes its analysis

IT is in some respects unfortunate that the scheme of charging which arose out of Dr. Hopkinson's famous cost division forms so admirably logical and consistent a system. Admiration for its logic has sometimes caused its enthusiasts to push it far beyond the bounds of expediency and beyond the bounds even of logic itself. For if one may venture a contradiction, it is never logical to push a philosophy to its logical conclusion. The reason is that other logics cut across the one we are following, and if we have eyes only for our one line we shall inevitably fall into the pit where the lines cross.

Superficially at all events the maximum demand system of charging is absolutely watertight. We say to our power consumer something as follows:—"This year you have increased the maximum load on our bulk supply and distribution system by an amount of one kilowatt. Therefore you must pay for the year a sum of five pounds, representing the capital and operating charges on one kilowatt of all this plant." Good sentences and well pronounced; but why stop at a year? Should not such excellent logic be carried a little further?

We are charging £5 because we have in effect installed additional plant due to the demand of that consumer.* But obviously we cannot take the plant out again at the end of the year. If the consumer has compelled us to purchase extra plant we should compel him to pay the capital charges on that plant for so long as we have it installed. Such a line of argument would inevitably lead to making all demand charges continue for twenty or thirty years until the plant necessitated by that demand had been fully amortised.

Here logic contends with expediency, and perhaps with other conflicting logics. Apart from the manifest impossibility of enforcing such a charge it may be argued that it is not even reasonable. For if the consumer does not demand this kilowatt the following year someone else will be found to do so, and that someone else can pay the next year's charges. (We are discussing now the small and medium-sized power consumer, and we are assuming that no special capital expenditure has been incurred on account of his particular service). This is true *provided the undertaking is expanding in size* and not contracting. With this proviso it may be taken that there will always be fresh loads coming along sufficient to absorb the kilowatts installed for retiring consumers, and there is therefore no need to make the latter pay the capital charges for more than one year.

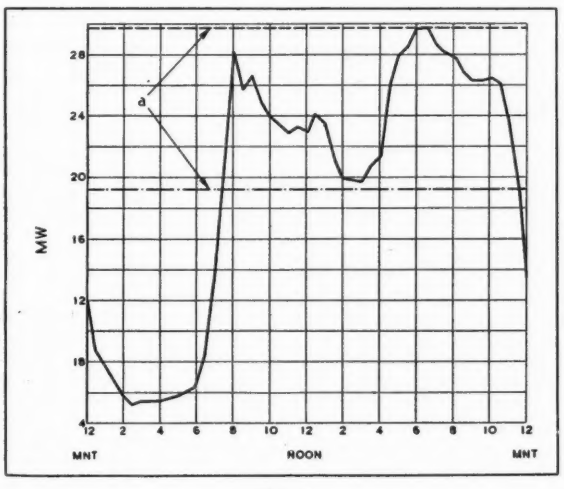


Fig. 1

This new line of reasoning however can itself be extended. If we accept the possibility of new consumers taking over the liabilities created by old ones, cannot it apply for less periods than one year? Why need we charge for more than a quarter's use or even a month's use of the demand if we can count on subsequent quarters or months being taken up by others? It appears in fact that the tariff argument cannot be settled by logic and must be based in large part upon expediency. We know roughly how much we have to collect from a certain group of consumers in order to cover all our costs and charges, and the apportionment of that total is a matter of politics as much as economics. Whether we charge for our kilowatt £x a year or slightly more than £$\frac{x}{4}$ a quarter or £$\frac{x}{12}$ a month (so as to achieve the same revenue) is not a matter that can be determined by cost arguments but must be settled by reasons of the market place and the dealer.

This being so, it is highly important to know what the ratio should be. Granted that the equivalent of £x per kW a year is rather more than £$\frac{x}{4}$ a quarter, the question is "How much more?" The provision of an answer to this question involves some analysis of the load factor.

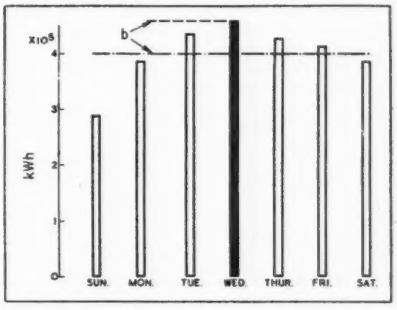


Fig. 2

Bulk Supply Charges

A very similar question arises not in connection with the small individual consumer, but with bulk purchasers supplied from the grid. A proposal put forward at the last I.M.E.A. annual meeting called for an alternative to the grid tariff basing the annual kW charge on the average m.d. of the four winter months, even if this should mean some alteration in the amount per kW.

Whatever may be the fate of this proposal it is important to have a quantitative statement of the problem. If demand readings are to be averaged over several months, just as much as if they are to be separately assessed each month, there will have to be a small upward modification of the charge in order to keep the revenue unaltered. Before any such change is made it is necessary to know how much adjustment will be needed. This will clearly depend on what the monthly fluctuations are, and this in turn depends on the composition rather than on the magnitude of the load factor.

Load Factor Components

The term load factor, when used without qualification, commonly means *annual* load factor—*i.e.*, the ratio of the actual units supplied in the year to the number that would have been supplied had the year's biggest peak been maintained continuously. In figures, $L = \frac{\text{kWh of year}}{\text{Peak kW} \times 8760}$. This yearly load factor can usefully be divided into a number of components each of which plays its part in reducing the overall figure. It might be said that the lowness or imperfection of any annual load factor is the product of the lowness of all these components.

*It is assumed that we have allowed for diversity. Also, of course, the argument assumes that the consumer is representative of a large number. A single kilowatt is neither here nor there, but with a sufficient number *sooner or later* fresh plant must be installed and must be paid for.

In the first place the daily load curve fluctuates from a small value in the early morning to a peak usually in the late afternoon. The load factor even of the best of such days is commonly only of the order of 60 per cent. Then there is a weekly fluctuation, some days being smaller than others, resulting in an average daily output less than that of the peak day. Finally, there are seasonal fluctuations, so that if the peak occurs in a certain week in December probably no other week or month would be so high, and certainly the average month of the year will be considerably smaller.

Fig. 1 shows the station load curve of a supply system in the Greater London area. (Undertaking 3 in the table below). The curve refers to the day during which the annual peak occurred (Wednesday, December 21st). The mean height of this figure is indicated by a chain dotted line. The ratio between this and the maximum height of the diagram gives the load factor for the day, namely 65 per cent. Let this ratio be represented by the symbol *a*.

Fig. 2 shows the station output for each day of the week during which the year's peak occurred. The biggest output occurred on peak day*, although this will not always be the case. What will be the case, however, in almost all instances, is that the average daily output during this week will be less than the output for peak day. This ratio, called *b*, is represented by the height of the chain dotted line divided by the height of the Wednesday column. The reason for this ratio being generally less than unity is that there is often a cyclical fluctuation during the week, *e.g.*, a smaller week-end consumption in industrial areas or a higher domestic or commercial load on certain days. The smaller days lower the average, whilst the peak will usually occur on a day having a large total output. However, even if *b* is greater than unity the formula given here will still apply.

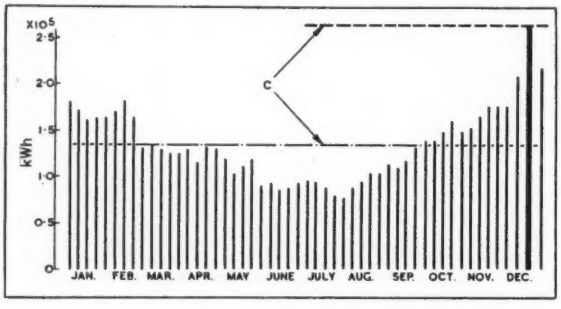


Fig. 3

Fig. 3 shows the station output for each of the fifty-two weeks in the year. Once again, the peak week stands out as the highest (in this case, very much the highest) of the year. In any case it will be well above the average week's height, indicated by the chain dotted line. There will then be a third ratio (less than unity) between the mean weekly height and the peak week height, and this ratio is represented by the symbol *c*.

We have now succeeded in analysing the year's load factor and splitting it up into its three principal components. These three quantities *a*, *b*, and *c*, (each usually less than 1) when multiplied together will give the annual load factor. In equation form :—

$$a = \text{load factor of peak day} = \text{ratio } \frac{\text{kWh of peak day}}{24 \times \text{peak kW}}$$

$$b = \text{day/week factor} = \text{ratio } \frac{\text{peak week kWh}}{7 \times \text{peak day kWh}}$$

$$c = \text{week/year factor} = \text{ratio } \frac{\text{year's kWh}}{52 \times \text{peak week kWh}}$$

$$\text{Then } a \times b \times c = \frac{\text{Year's kWh}}{\text{Peak kW} \times 24 \times 7 \times 52} = \text{L}$$

The following table shows values of *a*, *b*, *c* and L expressed as percentages for six different undertakings. Example 1 is for an independently operating station in the East where the maximum variation in sunset time in only one hour. It will be noted that the seasonal fluctuations are extremely small, the average week of the year being only 5 per cent. short of peak week. At the other extreme example 2 is for a North British station where the sunset variation from summer to winter is about five hours. Examples 3 to 6 are for undertakings in the Home Counties. It is noteworthy that although the examples cover a yearly load factor range of over 2 to 1 there is almost no difference in the daily load factor. The difference in the yearly figure is therefore due to the other components, and particularly to the seasonal fluctuations.

Factor		*a*	*b*	*c*	L
Ratio		Hour : Day	Day : Week	Week : Year	Hour : Year
Undertaking.	Lowness due to m.d. (MW)	Low night load	Low mid-week or week-end load	Seasonal fluctuations	—
		RATIOS PER CENT			
1	7.1	59½	94½	95	53½
2	83	61½	81½	68	34
3	29.7	65	85	48	26½
4	8.4	60¼	94¼	45¾	26
5	6.3	59	85¾	48	24¼
6	3.1	60	94¼	53	30

There have been many schemes of load factor improvement, but before trying to better it one should see what makes it bad, and this means a careful analysis of the elements composing it. Annual load factor is too large a mouthful to be swallowed whole. It is not a single entity but, like charity, it covers a multitude of sins, and the only salvation is to take it to pieces and try to reform each separate portion. Unless this is done, sectional changes become submerged in the whole, and it is impossible to discover precisely what is happening. Moreover there is a distinct possibility that one portion may be improved at the expense of another.

Thus suppose that the peak day load curve discloses a predominant domestic demand. The obvious corrective would be an increase in the industrial load. The latter, however, might prove to be highly seasonal in character with a big load in certain months or certain days in the week. The effect on the peak day curve might be excellent, yet the result on the year's load factor might be highly disappointing. In symbols, *a* has increased but *b* or *c* are smaller so that the overall product is little better than it was.

An analogous situation occurs in works costing. It used to be thought when several manufacturers independently estimated the cost of a certain article at approximately the same total figure that this must mean that the figure could not be improved upon. But when the total was split up into three or four separate processes it was often found that one firm was very much lower on one process and another firm on another. What appeared to be 100 per cent. efficiency was in fact merely the averaging out of a number of separate inefficiencies. Such detailed costing is an essential element in scientific production, making it possible for each separate component of cost to be brought up to the level of the best in that group. In the same way, two electricity undertakings in similar situations and with approximately the same annual load factor may find that the component values are quite different, and this may point them both the way to detail improvements.

Varying Assessment Periods

There is another use for load factor analysis, mentioned previously, and that is in connection with assessment periods. But for this purpose the splitting up must be done on a different basis, namely kilowatts instead of kWh. To illustrate this, take a load whose m.d.'s have been recorded every month, and find the average value of the twelve readings. Group them also into quarters and find the average of the quarterly m.d.'s. Finally note the largest demand of the year and the total number of units.

Let k_1 = the annual units ÷ 8760 = the annual mean kW
„ k_2 = the mean of the 12 monthly m.d.'s
„ k_3 = the „ „ „ 4 quarterly m.d.'s
„ k_4 = the maximum kW for the year.
„ $\frac{k_1}{k_2} = x$, $\frac{k_2}{k_3} = y$, $\frac{k_3}{k_4} = z$. Then $x \times y \times z = \text{L}$ the annual load factor. Thus *x*, *y*, and *z* are components of the load factor in the same way as *a*, *b*, and *c* but in this case the division has been made on a basis of m.d.'s. rather than kWh. In an actual case (example 3 in the table) *x* equalled 40 per cent., *y* equalled 88 per cent., and *z* equalled 75 per cent.

*The expressions "peak day," "peak week," etc. are used to indicate the day, week, etc. on which the year's m.d. occurred. This will not necessarily (though it will very frequently) be the day or week in which the kWh were a maximum.

This method of analysis is useful in comparing annual with quarterly or monthly m.d. metering. Thus, if with the above undertaking the total costs per kW of annual demand worked out at £10, the corresponding figure for quarterly metering would be $\frac{10}{4} \div z = \frac{10}{4 \times 0.75} =$ £3 6s. 8d. per kW. The corresponding figure for monthly metering would be $\frac{10}{12yz} =$ £1 5s. 3d. These would not, of course, be adequate figures to charge individual consumers. The load factor of a group is always higher than the average of the individuals composing it, and the same must be true of the load factor components. Values of x, y and z appropriate to individual consumers must therefore be found before the above principle can be applied.

Finally it should be noted that even the annual load factor is itself part of a greater whole. It would be quite possible for an undertaking to have a high load factor each year in succession, yet, if the magnitude of the peak fluctuated from year to year, the effective load factor (so far as plant was concerned) might be a very bad one. The true load factor for plant utilisation should then be taken over a period of some thirty years! Fortunately this point is only an academic one so far as this country is concerned. It does not arise with generation costs for an undertaking buying in bulk on yearly readings, and it does not arise in any case in which the yearly load is increasing and has no downward fluctuations.

Conclusion

Summing up, it is clear that the use of the *annual* load factor as the determinant of fixed costs is quite arbitrary—the period is too long for some purposes and not long enough for others. To the power user, and especially the small man, a year is a long time, and it seems a heavy imposition to have to pay a whole year's capital charges on account of a single overload. On the other hand to the supply engineer, having to make his five-year plans and to purchase plant with twenty to forty years life, a year is but a day in his sight. He has to find his capital charges, come what may, every year until the debt is amortised and, naturally, he desires at least a year's guarantee or, better still, a seven-year agreement.

Evidently this is a case where the supply engineer must be willing to be a retailer as well as a wholesaler. The retailer of commodities is ready to serve the casual shopper as well as the regular customer, and the retailer of services must be prepared to do the same thing. It is true that he is burdened with a far bigger proportion of fixed charges and cannot afford to be quite so casual in his charges to his clients. But something of this time-spreading function he should be willing to perform at an appropriate price. Although he himself purchases on nothing less than an annual basis and has to find capital charges over a period of years he should be prepared to charge his customers on a quarterly or even a monthly basis if the need is there.

The big power user may be quite willing for a contract and for yearly m.d. readings but such terms press hardly on the small man with a fluctuating business run on a narrow financial margin. He will gladly pay a higher proportional price per kilowatt for the advantage of quarterly readings or a still higher figure for monthly readings of the demand. This is a service which the undertaking may well provide, but it must get away from its *idée fixe*—the theory of an exact price in which every consumer precisely underwrites his just fraction of all the undertaking's liabilities.

In conclusion let it be repeated that there is no strictly logical term for m.d. charges (short of the lifetime of the plant itself) and the appropriate time is purely a question of expediency. In fact the whole idea that there is a correct unimpeachable allocation of fixed charges which can be fastened down to each individual consumer is an illusion—a will-o'-the-wisp that has lured countless supply engineers into the morass of tariff construction. It is time that this particular area was railed off with a cordon round it and a notice displayed—

WARNING!
UNEXPLODED FALLACY

Let us leave this desolate area of academic theorising and get down to the practical business of selling electrical service. If there we find a demand for supplies on short-period terms let us not oppose it with pre-conceived "logic," but rather set about immediately to estimate at what price we can afford to supply it.

Watt-hour Meter Testing

Effects of the 1936 Act

LEGAL and technical implications of the Electricity Supply (Meters) Act, 1936, are reviewed in a paper, which is largely instructional, by Mr. Alwyn Evans (Aberdare Urban District Electricity & Transport Department) released by the Meter and Instrument Section of the Institution of Electrical Engineers.

The object of the Act is to make "better provision" for the measurement of energy purchased by ordinary consumers (not those subject to special agreements) from authorised suppliers, with a compulsory obligation to ensure accuracy, which means that the majority of undertakers have had to spend much money on the testing and replacement of meters.

One result appears to the author to be that if a consumer disputes the accuracy of a certified meter which has been installed on his premises by an authorised supplier, consequently refusing to pay his account, then it will be permissible to disconnect the supply because the registration of such a meter will be deemed to be conclusive evidence of the correct value of the supply.

Turning to technical implications, the author illustrates with the aid of tabulated data methods of determining calibration corrections that may be made necessary by the conditions imposed upon indicating wattmeters when used as sub-standards for testing other instruments' errors; thereby emphasising the supreme importance of potentiometers and their accessories, which deserve the greatest respect of those persons entrusted with their handling and operation and maintenance. The merits of two or three single-phase rotating sub-standard meters over one polyphase instrument are said to be academic in one sense, mainly because they show clearly the physical changes taking place in a three-phase system when the power factor is below or above 0.5. But there are polyphase meters of a universal type; their three current coils are placed in series with each other for single-phase testing, which arrangement produces the greater torque that is so important at small loads.

The second half of the paper is more descriptive, relating to single and polyphase equipment, including layout and circuit diagrams of the testing station with which the author is concerned. For the transportation of meters from the testing station to consumers' premises delivery vans are fitted with tray-like wooden boxes, partitioned to accommodate various sizes and lined with "Sorbo" rubber 1 in. thick to minimise shock and vibration.

The author's testing station was designed to deal with 2,000 meters per annum, or 22 at any one time. The operating cost in respect of single-phase quarterly and prepayment meters totals 50d. per meter, which is made up of annual capital charge of the building 0.25d. and of the testing equipment 2.49d, rates 2.64d, energy for heating and lighting and testing 0.92d, disconnecting and changing meters 11.66d, cleaning and painting and overhauling 8.36d, testing and calibrating 11.28d, calibration of sub-standard wattmeters 2.4d, office records and stores 7.5d. and the certification fee 2.5d. per meter.

Finally the author states that he cannot subscribe to the view that there is not any real need to prescribe any method or specify apparatus for testing meters on site. He believes that in cases of dispute the conditions imposed on the meter in service should be a factor in solving disagreement between consumer and supplier.

I.E.E. Ballots

Ballots in respect of candidates for election and transfer are to take place at formal meetings to be held at the Institution of Electrical Engineers at 12.30 p.m. on Thursdays, February 20, March 13th and April 3rd, and at 2.30 p.m. on May 8th before the annual general meeting.

Domestic Load Control

Meeting New Peak Conditions

THE three principal components of the domestic load have become thermal, since the relative share of the whole demand for purposes other than cooking and water and space heating is shrinking to a mere trifle in typical electrified households. The characteristics of this heating load and the cost of furnishing it are critically reviewed in a paper by Mr. P. Schiller (International Electrical Association) released by the Institution of Electrical Engineers.

Low kWh charges in two-part tariffs, primarily intended to cultivate cooking and water heating loads, have actually created a far more pronounced seasonal radiator load, particularly in areas that have been energetically developed. Failing systematic research into the peculiarities of the cooking load in this country, recently-published data appear to indicate that the nation-wide average of the annual consumption per cooker cannot be expected to exceed 1,000 kWh. The after-diversity demand (the maximum demand of a group of similar appliances divided by the number connected) may reach 0.7 kW per cooker at midday on weekdays, or 1.75 kW on Sundays and 2 kW on Christmas day.

Thus the cooking load *per se* will retain its particular attraction only so long as the system peak occurs in the late afternoon, a condition that is gradually disappearing in this country. With low-voltage distribution systems catering for households, or residential development on traditional lines, the effective load factor of the demand for cooking purposes may be of the order of 10 per cent., which is lower than that of the lighting component. Cooker saturation throughout the country is said to be approaching 20 per cent. Fresh departures will be needed to prevent it remaining confined to a minority of potential users. One possibility is to introduce thermal-storage cookers on a large scale; but, if they were made really effective, they would be elaborate and expensive. Another is to control the midday peak.

The advance of domestic electrification is having a marked effect upon system peaks, raising the necessity for planning and supervising demand to avoid overloading

Water heater saturation is about 10 per cent. This element is more complex, because of the greater variety in the habits of different classes of users. Most installations in this country already operate on the storage principle; even with the most popular thermostatic types restrictions due to volume and recuperation time remain. Thus water heaters are preparing the way for the introduction on a large scale of methods and apparatus necessitating more extensive planning and supervision of the demand, which is the author's main theme.

Space Heating Considerations

Space heating is bound to be confined to one portion of the year and to make the heaviest demand during a season already burdened with lighting peaks. Bedroom radiators (morning and off-peak evening use) are generally thought to be a desirable class of load, but it is still debatable whether even exclusively electric living-room heating creates, at present, a desirable load.

The author illustrates graphically the overloading influence of residence heating during cold snaps in localities with preponderating domestic loads. It has been contended that this problem can be solved by making electricity the sole source of space heating for the household. The author's reply is that under conditions typical of millions of potential all-electric consumers of the wage-earning class the chance of this policy being remunerative might exist only if the system peak were still to occur at a conventional time, perhaps between 4.30 and 5 p.m.

The author endeavours to demonstrate that it is not feasible for distributors purchasing energy at the usual pre-war grid tariff to carry a developed domestic load at a tariff incorporating a running charge of 0.5d. per kWh supplied without incurring a financial loss, or subsidising the domestic by other classes of load. Yet this figure seems to be the maximum which will allow liberal use of electricity for heating by the less wealthy consumers.

This deadlock is caused by the unsatisfactory yearly load factor of household heating, which the author contends will not much exceed 30 per cent. as the eventual maximum attainable. He suggests that control of at least the water and space heating loads, accompanied by intensive encouragement of thermal storage appliances, is the only means of raising the load factor to the level necessary for sound development. The fundamental disability of most methods, some of which are briefly outlined, is that they only lend themselves readily to the removal of blocks of load, or to complete de-energisation of appliances for sustained periods, but not to progressive variation of the collectively controlled load, or partial restriction.

The author's method is intended to enable the demand made by individual household installations to be limited to values that can be adjusted progressively in accordance with the system load. The share in plant capacity thus allocated to each controlled consumer is proportional to the amount paid as a fixed charge under a conventional two-part tariff.

Each controlled consumer's installation is equipped with a device for limiting the aggregate demand of the appliances submitted to restriction, the demand limit being progressively varied by remote control from one or more central points. If the aggregate exceeds the instantaneous demand limit, the controlled appliances are periodically disconnected and reconnected in a cycle of such ratio of "on" and "off" periods as to prevent the resultant mean load from exceeding the instantaneous set demand limit. During periods of maximum restriction the demand limit may be zero; at times of partial restriction a definitely limited amount of energy is at the disposal of the consumer who is free to use it as he thinks fit.

The restrictive device is a contactor, actuated by a demand limiter with which is incorporated a "receiver" relay that enables adjustment to be done remotely. The apparatus is of the meter type, simultaneously serving for registering the energy consumed. Differential gear is added, one side being driven from the meter spindle and the opposing side by a small motor. The planet portion of the gear actuates a switch in such a way that when the speed of the meter (variable) exceeds that of the motor (constant) the controlled load is (after a time lag) disconnected. If this causes the speed of the former to fall below the latter the circuit (after another time lag) is restored. Progressive demand control is achieved by altering the setting of the limiter remotely, such as by superimposed supervisory signals.

For two-part tariff costing, existing methods of assessing the fixed charge can be retained; this yearly amount is converted into a "service rating" by division into a constant representing kW per £1. The service rating determines the maximum demand the consumer is allowed for his restricted appliances; if he desires more during periods of de-restriction and partial restriction he must pay a proportionately greater fixed charge. A simple auxiliary contact can be arranged to render the limiting function inoperative upon the setting reaching its maximum. Demand limitation will then take place only when the supplier desires to curtail load.

Effect on Diversity

To the objection that the scheme proposed will interfere with the beneficial effects of diversity, the author replies that poor diversity is in any case a characteristic of radiator load, especially during cold snaps. It is then only fair that the amount of energy the supplier can allow should be shared equitably.

To obviate the incongruity that tends to follow attempts to base centralised control on sub-station load, the author favours centralisation at a generating or bulk supply station. It is proposed to furnish each consumer with a minimum guarantee in the form of a chart indicating the percentage availability of supply and of periods during which limitation may be applied, together with an indicator (operated synchronously with limiting meter) to show what power is available.

Instead of having to watch patiently while a cold snap pushes up the demand, distributors buying energy from the C.E.B. may, by the author's means, decide for themselves what maximum they are prepared to accept. If desired, controlled load may be removed automatically in order to prevent the total system load from exceeding a pre-set value.

Rotating Magnetic Fields

A Practical Theory of Polyphase Machines

By W. Woodiwiss, A.M.I.E.E.

In this article the author examines and explains in a "visual" manner the phenomena upon which the operation of polyphase machines depends

THE production of a rotating magnetic field by polyphase currents is the basic phenomena of all polyphase alternating-current motors. The usual analytical treatment does not itself constitute a full explanation; it is necessary to supplement this with a concrete knowledge of the physics of the process, that is, with visions of the component fields of the phase conductors and their association to form the resultant rotating field. In the practical problems which arise in connection with motor windings, such as reversing the motor rotation or detecting and correcting a reversed phase, it is this concrete knowledge which will prove both more useful and more valuable and, as a consequence, much more interesting.

The necessary elements for a simple two - pole three-phase stator winding are illustrated in fig. 1. The beginning of

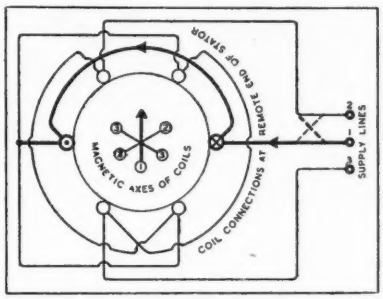


Fig.1.—Reversing field rotation

coil (2) is placed 120 deg. from the beginning of coil (1); the beginning of coil (3) is placed 120 deg. from coil (2). The starting ends of the coils are each connected to each of the three supply lines; the three ends are joined together to form the star point.

Each coil when carrying current will produce a magnetic field along its magnetic axis, as indicated. The direction of the field along the axis will depend on the direction in which current is traversing the coil; for example when coil (1) is carrying current in the direction indicated, the direction of the flux will be as shown; a reversal of the current will reverse the direction of this

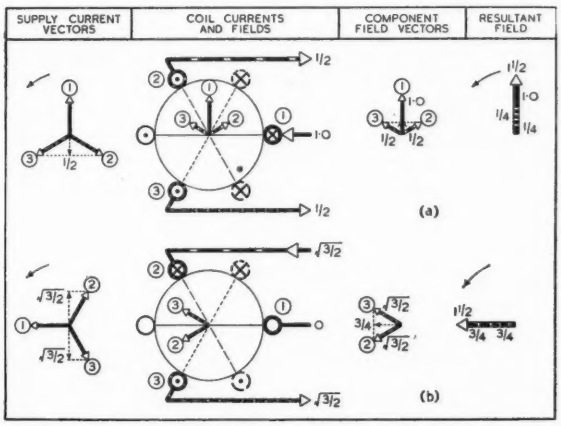


Fig. 2.—Production of rotating field

flux. The magnitude of this flux will at any instant be proportional to the magnitude of the current.

The application of these elementary considerations to the stator when supplied with three-phase current is illustrated in fig. 2 (a). The current vector diagram shows that the current in phase (1) is positive, flowing into the winding; the currents in phases (2) and (3) are negative and flow out of the windings. The direction of the current flow round the coils is indicated by the usual conventions—a cross for current flowing away from, and a dot for current flowing towards, the observer. The direction of the magnetic fluxes in the individual coils can now be determined and indicated. The instantaneous magnitudes of the currents are obtained by projecting the current vectors on to the vertical. The individual magnetic fields at any instant are proportional to the instantaneous values of the currents in the coils, and their magnitudes may accordingly be represented by these current values.

Since the direction and magnitudes of the three component fields are now known, it is possible to compound them and to determine the direction and magnitude of the resultant. This resultant, due to the combined action of the coils, is seen to be one and a half times the maximum flux due to one coil alone.

Fig. 2 (b) shows the current vector a little time later, and the above process is repeated to determine the direction and magni-

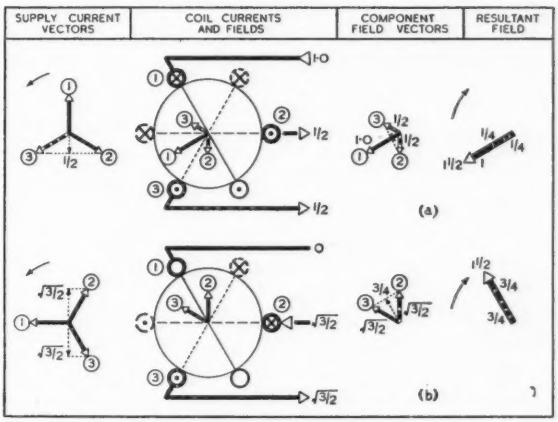


Fig. 3.—Reversed-field rotation

tude of the resultant. It is seen that whilst the magnitude remains constant, the field has rotated through an angle equal to the angle of rotation of the current vectors. The construction of further diagrams for later periods would emphasise the above conclusions.

These diagrams make clear the fundamental fact that the three alternating currents supplied to the coils placed at 120 deg. produce instantaneously co-directional currents in a belt of two or three adjacent stator conductors. These co-directional currents combine at any instant to give a magnetic field of constant magnitude and of constant angular velocity.

Speed of Rotation

When one of the coils is carrying the maximum

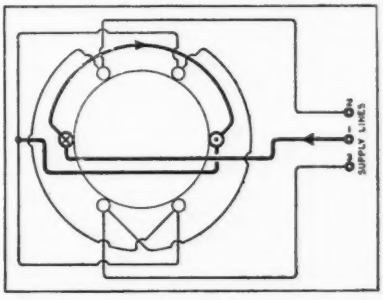


Fig.4.—Reversed-phaseconnection

current, it is evident that the resultant field must be along the magnetic axis of this coil. When the current through this coil has reversed, the direction of the resultant field will have reversed; that is, the time taken for the current to reverse

from its positive to negative maximum equals the time taken for the field to rotate from one pole to the next.

If f = frequency of supply in cycles per second, the time taken for the current to reverse from maximum positive to

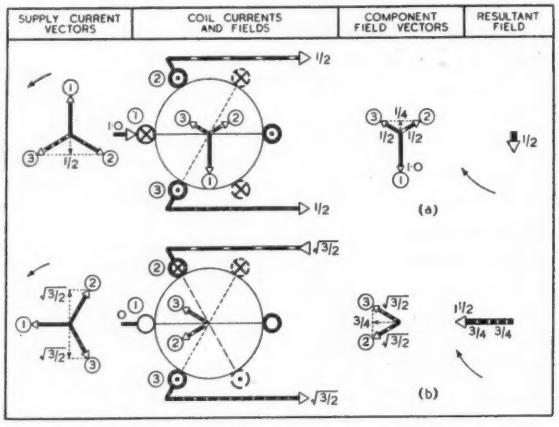


Fig. 5.—Effects of reversed-phase connection

maximum negative = 1/2f sec. Hence the time taken for the field to reverse polarity, that is for the resultant field to rotate from one pole to the next = 1/2f sec. Then if P = total number of poles, the time taken for one complete revolution of the field = p/2f sec., or revolutions per second of the field = 2f/p.

Reversed Rotation

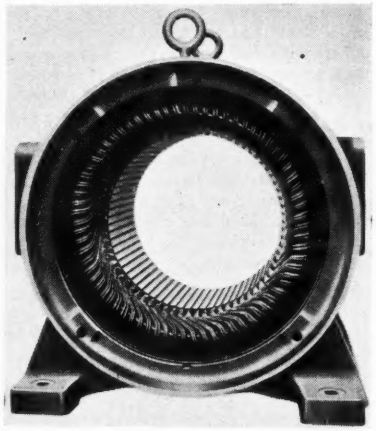
The direction of rotation of the field can be reversed by reversing any two of the supply connections to the motor. The broken lines in fig. (1) illustrate the change-over. The application of the analysis diagram shown in fig. 3 makes it evident that the result is a reversed rotation of the field.

Reversed-Phase Connection

It may be found that a new motor connected to the supply, particularly if through a star-delta starter, has poor starting performance and heats excessively on load. If the windings are sound, this poor performance will probably be due to a reversed-phase connection (fig. 4). A reversed-phase connection results when a beginning of one phase winding is connected to the ends of the other two phase windings. The effect of this is analysed in fig. 5.; which shows that the resultant field varies in magnitude. It is due to this reduction of the field to one-third of its normal value that the starting and running performance is impaired; one-third the field strength means one-ninth the torque.

It is useless, in general, to try to correct a reversed connection by reversing one phase winding, and, if this fails, reversing another. The correct procedure is to reverse one, and if this fails to rectify the fault, its connections must be restored to their original condition before reversing the next phase.

A slip-ring motor, after the three stator phases have all been dealt with, may still fail to come into line, because the reversed-phase connection is in the rotor. To check this the stator is switched on to the supply, and the open-circuit volts of the rotor are then measured. If these are unequal a reversed rotor phase winding may be suspected, and the windings reversed as for the stator.



Stator of 100 HP induction motor, 440V, three-phase, 50-cycle, eight-pole, double layer winding (Metropolitan-Vickers)

In conclusion, a word of warning. I was called out to investigate a complaint of poor starting and poor performance of a new 20-HP motor I had installed a short time previously. I found that the line shaft driven by the motor took a long time to reach speed, and that the line-shaft speed dropped when load was applied; the motor was running perfectly, but the stretch of a new belt had impaired transmission efficiency and the poor performance was due merely to belt slip.

Company Sued by Director

IN the King's Bench Division on February 12th, Mr. Justice Asquith concluded the hearing of an action by Mr. Sidney B. Marshall against Peto Scott Electrical Instruments (Holdings) Ltd., claiming £73 19s. 6d. alleged to be due to him as remuneration in respect of the plaintiff's acting as director of the defendant company from April 28th to October 25th, 1939. Mr. Marshall also claimed damages for alleged breach of contract contained in letters passed between him and the company. There was also a claim by Mr. Marshall for damages for alleged breach of agreement by the defendants to allot to him 6,000 1s. shares in the company. Further, and in the alternative, Mr. Marshall sought a declaration that he was entitled to be allotted the 6,000 1s. shares and an order calling upon them to allot the shares to him.

Mr. Marshall's case was that it was agreed between him and Mr. Scott Worthington, chairman of the board, that he should serve the company in their business for a period of years from March, 1939, and that his remuneration was to be in shares and a salary of £600 a year. Plaintiff alleged that in April, 1939, he was appointed a director, which carried a remuneration of £150 a year. Mr. Marshall said that he was wrongfully dismissed in October, 1939. He had been paid his salary to that date, but no shares had been allotted to him. He now claimed £73 19s. 6d. for director's fees and £228 damages for breach of contract to pay him his full salary.

The company by their defence set up a number of replies. They alleged that the plaintiff had failed to qualify for the shares within the stipulated time and therefore ceased to be a director. They admitted that the plaintiff had not been paid his director's fees and denied that plaintiff did any work to entitle him to those fees. In any case the company said plaintiff was only entitled to £25. They further alleged that the services rendered by the plaintiff to the company were of no value to the company; he had not carried out his promise to introduce new ideas and the manufacture of novelties and increase their business. The company also alleged that Mr. Marshall had failed to discharge his duties satisfactorily, and that under all the circumstances of the case they were entitled to determine his employment. With regard to Mr. Marshall's claim for the allotment of shares, the company pleaded that there could be no allotment of shares till he had remained with the company for a year.

In reply, Mr. Marshall denied that he had caused the company any loss, or that he undertook to do what the company alleged. He pleaded that he possessed all the necessary business qualifications and experience for the post and was capable of running the company.

The hearing of the case occupied several days. His Lordship in giving judgment reviewed the facts of the case. In his view a promise to introduce new ideas was not a contractual obligation and was far too wide to be the subject matter of a legal dispute. Certain complaints were made against the plaintiff, but his Lordship could see no substance in them. The summary dismissal of plaintiff was not justified during his probationary period, and therefore plaintiff was entitled to damages. These he assessed at £228. He was also entitled to the value of the shares to be allotted to him, viz., £50, and his director's fees of £73 19s. 6d. A counter-claim by the company was dismissed. Judgment was entered accordingly with costs.

COMMERCIAL and INDUSTRIAL

Woman Director Bound Over. New Zealand Trade Handicaps

Domestic Appliances Price Increase

WE are informed by the British Electrical and Allied Manufacturers' Association that the heating, cooking and domestic appliances manufacturers have collectively decided to operate on and from March 1st an all-round increase of 33⅓ per cent. on price levels ruling at the outbreak of war. This decision is due to increases in production costs experienced up to January 31st and is to apply to all products detailed in category (1) Schedule (5) of the Electrical Fair Trading Policy, with the exception of boiling plates and rings (when supplied specifically as spares or replacements on domestic cookers), and immersion heaters, both these items being subject to separate consideration. Urns being of an industrial character are also excluded from the decision.

Speeding Up War Risk Claims

The Board of Trade is making a fresh drive to speed up both payments on account and final settlement of claims under the commodity insurance scheme of the War Risks Insurance Act. Directions prepared by the Board showing how this may be done are to be sent through the Board's agents—the insurance companies and Lloyds who issue the policies—to every trader in the country whose stocks are insured under the scheme. About 250,000 traders are insured.

The Board is ready to facilitate prompt payments on account of claims where from any cause final assessment may be protracted or a trader is likely to suffer hardship pending final assessment and settlement. Traders who have already sent in full particulars of their claims and wish to obtain payment on account are invited to apply direct to the Board's assessor dealing with the claim.

Where completed particulars of claims have not been given a trader desiring payment on account should write to the agent—the insurance company or Lloyds—through whom the policy was issued. No special form is needed, but the policy holder should state the address of premises where loss occurred; date and cause of loss; nature of goods; estimated amount of loss, allowing for salvage; and grounds of application for payment in advance of final settlement.

Australian Import Restrictions

Under the Customs (Import Licensing) Regulations, importation of certain electrical goods into Australia from non-sterling countries will, from January 1st, 1941, be restricted. The items affected are static condensers, oil immersed type, mercury contact tubes, porcelain insulators and electrodes for neon signs, the importation of which is prohibited; and headphones, parts of wireless receivers, other than cabinets, and glass bulbs for use in the manufacture of electric lamps (50 per cent. restriction). Restrictions effective from October 1st, 1940, include electric current rectifiers up to 100 kW, the import of which is prohibited.

Limitation of Supplies Prosecution

The first prosecution under a Limitation of Supplies Order was heard at Bow Street Police Court last week when the Hispano-Britannic Co., Ltd., and directors of the company were summoned for supplying goods between June and November last year in excess of the two-thirds permitted under the Order.

For the Board of Trade it was stated that the company was only registered in April, 1940, and was accordingly not allowed to supply controlled goods to unregistered persons. By pretending that it had a quota the company was able to buy and sell goods during October and November last at the rate of over £1,000,000 a year. On this it drew a commission and made large sums of money by doing practically nothing.

Counsel for the defence stated that the company was formed to trade with Spain, but licences to export to Spain were withheld and the company was forced to trade in the home market. One of the directors, Mr. A. S. Sinnatt, who was in entire charge of the business, registered with the Board of Trade, but was unaware that a licence was also required. The statutory books of account of the company were in order although their completion had been delayed by the absence of their accountant on service.

Fines totalling £300, with £21 costs, were imposed on the company, and the directors were also fined amounts varying from £120 to £300, with costs. On summonses for not keeping proper books of account Mr. Sinnatt was fined £200 and the other directors £20 each.

Alleged Trading with the Enemy

The case against Miss Doreen Grant Gibbons and Metal and Electro-Chemical Products, Ltd. who were alleged to have had financial and commercial dealings with the enemy again came before Mr. Justice Wrottesley at the Central Criminal Court last week. Last session, after a protracted hearing, Miss Gibbons and the company were found "Not guilty" on three of twelve counts; the jury disagreed on the other counts, necessitating a retrial.

Miss Gibbons and the company now pleaded "Guilty" to a number of counts and "Not guilty" to the remainder. The pleas were accepted by the prosecution and Miss Gibbons was bound over for two years in her own recognisances while the company was fined £700.

Fibre Rods and Tubes

The original B.S.S. for vulcanised fibre for electrical purposes, published in 1926, covered sheets, rods and tubes; the 1936 revision dealt with sheets only. A new specification for rods and tubes is now about to be issued as B.S.S. 934–1940, which is based on the results of comprehensive tests carried out by the Electrical Research Association. Limiting values are prescribed for various properties, and methods of test are described. Copies can be obtained from the British Standards Institution, 28, Victoria Street, London, S.W.1, price 2s. 3d. post free.

Trade with New Zealand

A few weeks ago we quoted some remarks of the *New Zealand Electrical Journal* upon the apparent lack of co-ordination between New Zealand's import selection and the United Kingdom's export licensing system. In a recent issue our contemporary returns to the subject. It says:—"There are may lines and many classes of apparatus which we could import into New Zealand without disturbing our local manufacturers and which the United Kingdom could presumably supply without unreasonable disclocation of the war effort, but these may be on the totally prohibited or the severely restricted list; while, in other cases, we are licensing goods for import which the United Kingdom is probably finding it difficult to supply, but which, under the pressure exerted by the vital need for export trade, are being manufactured and sent to us.

"As time goes on it seems reasonable to expect the position to get worse, and we should make it our first duty in New Zealand to see that a matter such as this, which is surely capable of reasonably efficient handling, should be thoroughly investigated and put on a basis which will serve the two purposes intended by the two respective countries—New Zealand with its import control to conserve sterling and the United Kingdom with its export control to conserve war efforts."

"Ediswan" Publicity Film

The accompanying illustration is taken from one of the new "Ediswan" short publicity films which, under the title "Candle Power," compares the making of candles with the manufacture of the modern electric lamp.

The film provides a sharp contrast in processes. From wick to finished product a giant church candle is built up by the candle maker, who climbs a ladder to ladle layer after layer of wax down the stem. The stems of electric lamps are more complicated and comprise thirteen different parts: the stem

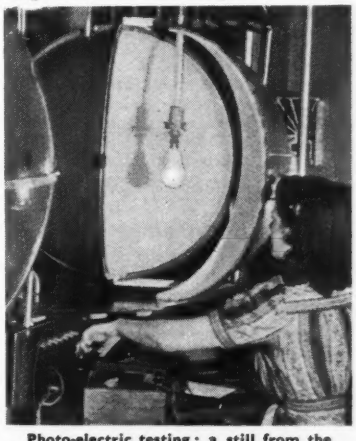


Photo-electric testing: a still from the "Ediswan" film "Candle Power"

tube, exhausting and gas filling tube, two fuse wires and fuse wire holders, two strips of copper-clad nickel-iron wire, two nickel wire leads, solid glass stem, and two copper lead-in wires.

As part of its 1940-1 lighting season publicity campaign, the Edison Swan Electric Co. Ltd. has embarked upon a series of these short publicity films, included in the popular "Signs of the Times" film magazines. Two other titles are "Let's See" and "When Shadows Fall" each dealing with interesting features of lamp making and various aspects of the vast and ever more important branch of modern lighting research.

Dealing with Fire Bombs

The generally accepted method of dealing with fire bombs, indoors at any rate, is, of course, by means of the stirrup pump and water, but even so the bomb is not actually extinguished but only made to burn out more quickly. Moreover this takes from three to six minutes, quite long enough for fires from other bombs to have got properly under way: incendiaries never come singly. How this difficulty can be overcome by

using a new type of extinguishing fluid, called "Incendex" was demonstrated to us a few days ago at the "Magicoal" factory by Berry's Electric, Ltd., which is acting as distributor for the electrical and allied trades. Used in a stirrup pump in the same way as water, but with the jet setting, this fluid extinguishes a fire bomb in a maximum of 20 seconds: actually at the demonstration it took 12 seconds, but 5 to 10 seconds is not unusual with an experienced operator.

The fluid is supplied in 1-gal, cans into which the base of the stirrup pump can be placed, one canful being sufficient to put out about six bombs. "Incendex" has no deleterious effect on fabrics, wood, rubber, etc., and the very small quantity utilised causes little mess and the minimum of "secondary" damage. Furthermore, the freezing point of the fluid is 15 deg. lower than that of water.

Apart from its use for putting out incendiaries, "Incendex," diluted in the proportion of one part to seven of water, forms a most effective fire extinguisher for ordinary purposes, while with one part to five of water it can be employed for impregnating wood, etc., to render it fire resisting.

Platinum in 1940

In the customary annual review of the platinum metals in 1940 by Mr. C. Engelhard, president of Baker & Company, Inc., it was pointed out that palladium in telephone relays and other types of electrical contacts found an increased market in 1940. Pure palladium, or palladium alloyed with silver, were used for this purpose. Prices for the platinum metals group remained relatively stable during 1940. Platinum remained steady at between $36 and $38 per ounce. Rhodium, since 1937, has been $125; palladium, since 1935, $24, and ruthenium, since 1938, $35 to $40 per ounce. Iridium was the only metal which fluctuated violently. At the beginning of 1940 it was quoted at $175, declined to $125 in September and at the close of the final quarter was quoted in excess of $275 per ounce.

Hot-Tinning

A detailed account of the tinning of steel, iron, copper brass and bronze by the hot-dipping process is given in a brochure compiled by Dr. C. E. Homer and issued as Publication 102 by the Tin Research Institute, Fraser Road, Greenford, Middx. The attractiveness of this method is that a few seconds immersion in a molten bath suffices, nothing more than washing or wiping being needed to finish it. Applications and limitations are discussed; such preliminary treatments as degreasing and pickling are fully described, as well as types of tinning baths, their operating temperatures, maintenance in continuous service, and how the tinning operations may be varied to suit the class of work and quality of finish desired.

Electric heating is being increasingly used for the smaller sizes of bath (Barlow-Whitney, Ltd.) and thermostatic control is often provided. To avoid small articles like screws and nails, which are tinned in bulk, becoming soldered together when the coating on them solidifies, they are centrifuged in a basket to remove surplus tin. A motor-driven machine for this operation is made by Thompson Bros. (Bilston), Ltd.

The tinning of copper follows the procedure outlined for steel, but there are important differences in detail which the author describes in the second half of the brochure, many practical difficulties being dealt with and advice given on control.

Treatment of Zinc

Among recent publications of the Zinc Development Association, now at Lincoln House, 15, Turl Street, Oxford, from whom they are obtainable in leaflet form, are reprints of articles that have appeared in technical journals, being translations of the German originals, on the electrical anodic oxidation of zinc and its alloys and the electrolytic colouring of zinc and aluminium; also on the machining of zinc alloys and the effect of cold-rolling them.

Industrial Circuit-Breakers

It was stated in the foreword to the 1937 edition that pending the issue of a specification for industrial circuit-breakers, B.S. 116–1929 could be applied for voltages below 3.3 kV. The 1929 edition, however, was very incomplete as regards the tests to verify the rating, so that a new specification now about to be issued as B.S. 936–1940, will be welcomed by all industrial users up to and including 660 V. It applies to single-phase and 3-phase gear having breaking capacities up to 44,000 A intended for use in those electrically remote parts of the system where marked asymmetry in the short-circuit current cannot occur, and where the re-striking voltage conditions are not severe.

A review of the specification by Mr. R. T. Lythall appears on another page of this issue.

Copies can be obtained from the British Standards Institution, 28, Victoria Street, London, S.W.1, price 3s. 10d. post free.

Deputy Manager Wanted at Paisley

The Paisley Corporation Electricity Advisory Committee recommends that a deputy manager and engineer shall be advertised for. The salary proposed is £590 rising to £620 per annum.

Tasmanian Inquiry

Our Australian Correspondent reports that the recent decision of the Tasmanian Government to order a public investigation into the administration of the Hydro-Electric Commission, resulted from statements by an associate-commissioner (Mr. C. B. Davies) that the Commission was not working satisfactorily, and from a report by the Auditor-General (Mr. F. J. Batt). The board of inquiry consists of the Chief Justice (Mr. Morris), Mr. T. Hytten and Mr. D. J. McClennand.

Fatality

An inquest was held at Lewisham on February 10th on Albert John Le Strange, who received a fatal electric shock at the Woolwich works of Siemens Bros. & Co., Ltd., on February 6th. Mr. L. F. Rogers, a departmental manager at the works, said that he was informed that while on a ladder and pushing wires into a pipe, deceased collapsed. Witness found the wires were still "alive," There was a rule that no one should work on live wires. He found that one fuse had been removed. A verdict of "Accidental death" was returned.

"Flight" Handbook

Such success has attended the publication, a short time ago, of the *Flight* Handbook that a second edition has become necessary. In producing this new edition the authors, W. O. Manning and the technical staff of *Flight*, have taken the opportunity of revising the work and making several extensive additions, including an entirely new chapter dealing with the latest developments. The simple language employed renders the book readily comprehensible by anyone who wishes to obtain a grasp of the theory of aeronautics. The publishers are Iliffe & Sons, Ltd., Dorset House, Stamford Street, London, S.E.1, and the price is 4s. net.

Car Headlamp Masks

A specification laying down requirements for A.R.P. headlamp masks for motor vehicles (BS/ARP. 36) has just been published because the earlier drawing of a recommended type of mask issued by the Ministry of Home Security was, in itself, found to be inadequate for ensuring that masks made in accordance therewith would, in fact, comply with the Lighting (Restrictions) Order. It was therefore felt that there was a need for a specification which would prescribe the optical performance of a mask but which would, at the same time, allow a good deal of scope to the designer.

The specification actually goes beyond the requirements of the order in that it defines, not only the maximum illumination, but also certain minimum illumination values, together with certain constructional requirements. One of the most important features of the specification is that it provides for the first time a definite basis for the testing of a mask.

Copies of this specification (BS/ARP. 36) may be obtained from the British Standards Institution, 28, Victoria Street, London, S.W.1., Price 4d. post free.

Calendars

Nalder Bros. & Thompson, Ltd., have sent us a neat desk calendar bearing the current month in bold figures with smaller insets of the past and succeeding months.

We have received a calendar in the form of a memo pad from Arthurs (Arthur Gray, Ltd.).

Catalogues and Lists

Midland Electric Manufacturing Co., Ltd., Reddings Lane, Tyseley, Birmingham.—A booklet, primarily for the use of contractors, containing illustrated details and prices of a range of switch- and fuse-gear designed to meet War Office requirements.

Metropolitan Electric Supplies, Metway Works, 2, Marshall Row, Brighton.—List No. 14140 of "Metway" electric heating elements for domestic appliances.

Changes of Address

The Bristol offices and stores of the Simplex Electric Co., Ltd., are now established at 92, Bedminster Parade, Bedminster, Bristol (telephone, Bristol 64221 & 2). The company's Southampton offices and stores have also been moved to 24, Carlton Place.

The Wholesale Electric Co., Ltd., has moved its Lewisham branch and stores to 56, Lee High Road, S.E.13.

Until further notice the registered address and head office of the Telegraph Construction & Maintenance Co., Ltd., Submarine Cables, Ltd., and the Selborne Plantation Co., Ltd., will be at Blackstone, Redhill, Surrey (telephone: Redhill 1056-7).

Rejafix, Ltd., have moved to 75, Baker Street, London, W.1.

"Illuminations" (Mr. W. J. Dowling) has removed to 56a, Chichester Road, Portsmouth (telephone: 74323) and asks for catalogues.

Maul & Murphy, Ltd., have moved to 3, Inglewood Road, London, N.W.6 (telephone: Hampstead 3938).

INFORMATION DEPARTMENT

GENERAL inquiries from readers relating to sources of electrical goods, makers' addresses, etc., are replied to by our Information Department through the post. Inquiries should be accompanied by a stamped addressed envelope.

Our extensive records enable us to reply to most queries, but occasionally we ask for our readers' assistance in tracing names and addresses not known to us. We should be glad to have such information regarding the following:—

DOUBLE H electric fire element.
MELLOLITE parchment fittings.
WORTHSIDE pumps.
GAIN-A-DAY washing machine.
ELECTRONAIRE MARKETING CO., LTD. (vacuum cleaners).

Electricity in Paper Mills

Advantages of the Private Plant

PAPER-MAKING processes are reviewed with the object of indicating the power and heating requirements in a paper, which is mostly descriptive, by Messrs. W. J. Mason and S. A. G. Emms (General Electric Co., Ltd.) released by the Institution of Electrical Engineers.

The annual production in this country is normally 2.3 million tons, involving the employment of 250,000 people and the consumption of 1.75 million tons of coal yearly, a large amount of steam being needed at several stages of the process for boiling, digesting, drying, etc. Therefore the authors uphold the contention that most advantages and higher thermal efficiencies are obtainable by mills that possess their own generating stations, containing passout turbines of 2,000 to 3,000 kW each, enabling their exhaust steam to be utilised for processing and the electricity generated for driving various machines by means of individual motors. Average requirements are tabulated and a heat balance sheet is included in the paper.

AC or DC?

The choice between AC and DC depends upon the type of mill. In some cases a mixed set has been installed (AC and DC generators driven by a common turbine) though it is difficult to determine the best capacity ratio, which is often upset by changes in manufacturing processes. The authors consider a cheaper and more efficient method to be AC generation in conjunction with pumpless mercury rectifiers to cater for the DC portion of the load, in the form of self-contained cubicles of up to 500 kW conveniently placed near the site of application, which are claimed to be more efficient and involve smaller maintenance cost than rotary convertors. For a plant capacity of about 5,000 kW the DC system appears to be the more suitable; the first costs of the two systems are about equal, if cabling be taken into account, so that the choice is largely influenced by the class of paper to be manufactured.

When speed variation is essential DC motors are rather more efficient than corresponding induction machines and cheaper in first cost than AC commutator types. Liberal rating and sound construction are necessary, since motors have to work about 132 hours a week in a humid atmosphere, which may be contaminated with chlorine; drip-proof enclosure is desirable. In many cases motors have to exert a starting torque several times in excess of their full-load torque, which fact must be borne in mind when selecting shafts, couplings and reduction gearing. Users' opinions differ greatly about the type of bearing to employ; the authors prefer the ball type for smaller machines and journal bearings for the larger sizes.

Switchgear has to deal with relatively large currents at low voltages, and sectionalisation is sometimes necessary to ensure that overload protection remains within the capacity of normal apparatus. In the case of large DC installations the possible short-circuit currents are particularly difficult to assess, but the authors do not believe them to be as great or as devastating as might be expected.

Accurate Speed Control Essential

The driving of the numerous auxiliaries in a paper mill is not specially onerous. Those immediately associated with the paper-making machine itself lend themselves readily to the "plural starter" system. The substance passing through the paper-making machine is extremely fragile, the sheet formed changes its length at different stages of the process, and it may be produced at the rate of 1,500 ft. per minute. Hence the necessity of maintaining accurately the speed-ratio between the various sections of the machine is paramount. Three electro-mechanical and one fully electrical methods of differential control are described diagrammatically by the authors. The starting torques of the various sections of the machine vary in the ratio of one to twenty, which great divergence considerably affects the design of the motors and coupling gears. As the calculation of these torques depends on a number of factors that cannot with any certainty be ascertained beforehand, liberal allowance is necessary.

The torque increases with speed due to windage and there is a critical velocity at which the coefficient of friction changes from the dry to the liquid state. The power cost per ton produced increases with increasing speed, but against this is the larger reduction of labour and overhead costs. The energy requirement of a 1,000 ft. per minute paper-making machine is about 90 kWh per ton, the bulk of which goes in friction. A paper-making machine is extremely heavy and the difference in loading with and without paper is only about 25 per cent., average inputs to the different sections of the plant being tabulated by the authors, who conclude with references to ways and means of obtaining great accuracy in controlling the speed of paper-making machines. For example one method recently employed with success depends upon comparison of two voltages, one of which is proportional to the machine's speed while the other is a standard which is independent of external influences.

When properly adjusted it is thus possible to maintain speed within 0.3 per cent. under ordinary paper mill conditions, but still greater accuracy may be obtained by employing a more sensitive kind of speed relay, such as a thermionic valve type, and by introducing into the comparison circuit a factor depending upon the first differential coefficient of the speed. This factor may be derived from the secondary of a transformer connected to the DC tachometer voltage and its presence makes possible a considerable speed-up in the response of the adjusting regulator without causing hunting.

With reference to super-calender, reel and slitter drives various equipments have recently been installed in which the brake on the unreeling stand is replaced by a generator arranged to maintain constant tension in the paper as it unwinds. Since the main reeler drive is usually of the Ward-Leonard type, it is thus possible to recover most of the energy that is otherwise dissipated in the mechanical brake.

Cables in Mines

PRACTICAL aspects of the distribution of electricity in mines was the subject of a paper read before the South Wales branch of the Association of Mining Electrical Engineers at Cardiff, on February 8th, by Mr. T. Storrs (H. M. Junior Electrical Inspector of Mines) who remarked that his paper was specially intended for the guidance of colliery electricians.

After explaining how to order cables, the author said that bitumen cables should never be considered in preference to the lead sheathed type for situations where the temperature was likely to exceed 110 deg. F. Shaped conductors for shaft cables should always be considered, for they reduced size and weight and were somewhat cheaper. It was advantageous to specify cables suitable for an insulated neutral system so that they would be supplied with more dielectric thickness. If the shaft was wet a sample of the water could be analysed to enable the cable to be specially treated if the water contained any corrosive substance. Waterproof tapes or braids under, between and over the armouring should be specified.

Many cables, especially in South Wales, had to be taken down very steep inclines and the suggestion was often made that it was safer to bury them. Where the roadways were dry and the ground settled, there should be no objection to this, providing the cable was laid in proper troughs or trenches, for this might be the only way to protect it from continual damage by runaway journeys. It was folly simply to lay the cable in the ground and bury it.

Turning to switchgear, Mr. Storrs pointed out that rupturing capacity was a subject which demanded special attention. A common fault was the position of the cable entry. In some instances the designer gave preference to compactness and low height instead of making the apparatus accessible. If a cable had to be bent very sharply under the switchgear it would be most unsatisfactory when one considered the strain on armoured cable glands.

In concluding his paper Mr. Storrs very strongly emphasised the importance of the duties of the colliery electrician and the need for him to become technically trained and obtain certificates of competency from the Association and, whenever and however he performed his duty, to think twice before acting.

ELECTRICITY SUPPLY

Minister and Reorganisation. Shelter Lighting Schemes

Accrington.—SHELTER LIGHTING.—The Corporation Electricity Committee has arranged for local contractors to undertake the provision of electric lighting in shelters at schedule prices.

Aldershot. — SHELTER LIGHTING. — The Emergency Committee has instructed the borough surveyor to prepare a complete scheme of shelter lighting for submission to the County Council. The estimated cost of lighting the public shelters, excluding the communal shelters, is £1,313.

Ayrshire. — COOKER CHARGES. — The County Council Housing Committee recommends that in future no charge shall be made to tenants of Council housing schemes in respect of cookers installed by the Council in houses where no other cooking facilities are provided. A total of 1,728 cookers has been so provided and the recommendation has the effect of reducing the rental charges in respect of cookers already supplied to the extent of £432 per annum. In other cases the existing charge of 5s. per annum is to continue.

Beddington and Wallington.—SHELTER LIGHTING.—The borough surveyor has been instructed to proceed with the installation of mains lighting in all shelters.

Birkenhead.—SUPPLY EXTENSION.—The Corporation Electricity Committee is seeking sanction to borrow £2,626 for substation and plant for a supply to a local leather works.

Birmingham.—ELECTRICITY FROM SLUDGE GAS.—Nearly 4,500,000 kWh of electricity was produced last year by the Birmingham Tame and Rea District Drainage Board from sludge gas. The Board's generating plant consists of eleven gas engines with a total capacity of 2,370 HP.

Blackpool.—SWITCHGEAR.—The Corporation Electricity Committee has obtained sanction to borrow £4,000 for increasing the rupturing capacity of the 33-kV switchgear.

Bridgend.—BULK SUPPLY AGREEMENT.—Under the terms of a new bulk supply agreement the Urban District Council will save nearly £5,000 per annum. The Council has expressed its appreciation of the South Wales Bulk Supply Association's work in connection with the agreement. It was stated that the fact that the Council was not a member of the Association had proved a serious weakness in the negotiations. The Council has deferred a decision on the question of joining the Association until it has received a report from its engineer.

Cardiff.—SWITCHGEAR RENEWAL.—Switchgear at the Mynachdy substation is to be renewed at a cost of £320.

Cheltenham.—SUPPLY ARRANGEMENTS.—At a recent meeting of the Corporation Electricity Committee the electrical engineer reported that the maximum load which was 9,003 kW in January, 1940, had increased to 11,518 kW, which was nearly double that experienced four years ago. The increase was partly due to additions to the industrial load and also to the considerable influx of residents, but really was due to the normal growth of the undertaking. The extra load had imposed a considerable strain on the distribution system and it was essential that considerable additions to it should be made before next winter. He was authorised to prepare a detailed scheme so that application could be made to the Electricity Commissioners for permission to proceed.

Chorley.—SUPPLY TO ALDERTON.—The Lancashire Electric Power Co. proposes to provide electric lighting services in premises at Headless Cross, Anderton.

Cornwall.—ELECTRIC LIFT.—The County Council proposes to install an electric lift at the County Isolation Hospital.

Dumfries.—EXTENSIONS.—In consequence of the continued rapid and substantial growth of the demand the Town Council is to extend its high-voltage main system, at an estimated cost of £995.

Eastbourne.—INCREASED CHARGES.—The Corporation Electricity Committee recommends increases in electricity charges in the town areas, as from the meter readings nearest to April 1st. The lighting flat rate is to be raised by ¾d. per kWh. Domestic all-in tariff: fixed charge from 8¾ to 12½ per cent. per annum of the rateable value; "unit" charge from ½d. to ⅝d. Business all-in tariff: "unit" charge from ¾d. to 1d. For power, new rates are to be substituted for the existing rates. In the rural area the "unit" charge of the domestic all-in tariff is to be increased from ½d. to ⅝d. for the two summer quarters and from ¾d. to ⅞d. for the two winter quarters. The increase in charges is expected to bring in an additional revenue amounting to approximately £23,000.

Friern Barnet.—SHELTER LIGHTING.—The U.D.C. Emergency Committee has asked the Northmet Power Co. to submit suggestions and quotations for lighting shelters.

Great Harwood.—SHELTER LIGHTING.—Tenders are to be invited by the Urban District Council for electric lighting installations in public shelters.

Supply Reorganisation

IN the House of Commons on February 12th, Mr. Loftus asked the Minister of Transport if with a view to encouraging the rebuilding in small country towns of factories destroyed by enemy action in large cities, he would consider the reorganisation of the electricity supply industry on a national basis, so that the charge for electric power would be uniform throughout the whole country.

Lieut.-Col. Moore-Brabazon said that it would not be practicable to undertake a reorganisation of such magnitude during the war.

Mr. Loftus: Does not my right honourable friend agree that decentralisation of industry will be impossible while certain towns are charging eight and ten times as much for electric power as other towns?

Lt.-Col. Moore-Brabazon: As the Minister charged with electricity—

(The rest of the answer was inaudible in the reporters' gallery on account of the laughter which this remark aroused).

Mr. J. Griffiths: Is my right honourable friend satisfied that the increased charges now being made are due entirely to the increased prices of coal?

Lt.-Col. Moore-Brabazon said that the increased charges could only be due partly to the increased prices of coal. There were other factors such as repair.

Mr. Thorne asked the Minister if he was aware that local authorities which had electricity under their control charged very much less than the electricity supply companies. There was no reply.

Hawick.—TERMINATION OF SUPPLY AGREEMENT.—The Town Council has received notification from the Urban Electric Supply Co., Ltd., of the termination of the present agreement as at December 31st, 1941. The position is to be considered further by the Town Council at a coming meeting.

Horsham.—OPPOSITION TO MID-SOUTHERN CO.'S BILL.—The Rural District Council is to oppose the Bill deposited in Parliament authorising the Mid-Southern Utility Co. to raise further capital, to confer further powers on the company, and for other purposes.

The Chichester, Petworth and Midhurst Rural District Councils are also to oppose the Bill.

Ilkeston.—SCHOOL SHELTER LIGHTING.—The Corporation Emergency Committee is to install mains lighting in twenty-eight school shelters.

Inverness.—NEW SUBSTATIONS.—The Town Council has decided to apply for permission to erect three new substations to cost £18,840. In connection with this it is proposed to lay a 6-kV cable from the electricity works and install mercury arc rectifiers.

Keighley.—LIGHTING OF SCHOOLS.—Tenders are to be invited for the installation of electric lighting in the Stanbury and Horkinstone Council Schools.

Kent.—HEATING OF SCHOOL SHELTERS.—At a recent meeting of the Education Committee it was reported that electric heating is to be installed in school shelters where electricity is readily available.

Leicester. — LOAN SANCTIONED. — The Electricity Committee has obtained sanction to a loan for the completion of works at the power station.

Manchester.—OVERHAUL OF SANATORIUM INSTALLATION.—The Public Health Committee reports that the electrical installation at the Baguley Sanatorium is in need of thorough and complete overhaul, including a great deal of wiring and replacement of fittings. The original estimated total cost was £3,500 and approximately £1,000 has already been expended on the work. Continuance of the work next year is recommended to the extent of £750.

X-RAY EQUIPMENT.—The Corporation Health Committee is to install new X-ray plant at Booth Hall Hospital, at a cost of £1,280.

Middlesex.—BATTERY CHARGERS.—Four heavy-duty battery chargers, costing about £25 each, are to be bought by the County Health Committee, to enable ambulance batteries to be maintained in good condition.

Mountain Ash.—LOWER SALES.—For the first time since the inception of the electricity undertaking thirty years ago no increase in sales of electricity is shown for last year. In his annual report Mr. E. W. Jones, the general manager, discloses that the total sales fell from 2,766,200 to 2,619,676 kWh. Energy for lighting decreased by 121,220 kWh, but that for other domestic purposes increased by 81,621 kWh, the fall in sales for domestic purposes being thus equivalent to only about 2 per cent. The revenue account shows a deficit of £580, as compared with a profit of £1,300, but this was anticipated. Thanks, however, to interest on various investments, to tax recouped, and

to certain other factors, the net deficiency is reduced to £316, as against £1,348 in 1938-39. The total revenue fell from £24,640 to £22,826.

Nelson.—CRITICISM OF BULK SUPPLY DECISION.—There was strong criticism at a recent Town Council meeting concerning the decision of the Barnoldswick District Council to take electricity from the Yorkshire Power Co. The decision was reached following an inquiry at Leeds by the Electricity Commissioners. Several councillors argued that Barnoldswick had not been fair to Nelson and the electricity chairman, Alderman Winterbottom, said that Nelson had appointed a special committee to deal with the matter. He thought they would hear more before long as to what they would do to recover unredeemed loans in connection with Nelson's first scheme when they took electricity for the first time to Barnoldswick.

Newark.—SUBSTATION EQUIPMENT.—An additional 330-kVA transformer is to be purchased for the Stanley Street substation at a cost of approximately £200, and a further feeder is to be laid in Pelham Street for £260. It is also recommended that an additional substation be provided and that application for consent to a loan of £1,500 be made.

Nottingham.—LIGHTING OF CREMATORIUM.—Electric lighting is to be installed in the chapels and other premises at the Nottingham Crematorium.

Nuneaton.—BULK SUPPLY FEEDERS.—Application is to be made by the Town Council for sanction to borrow £9,000 in connection with a scheme for interconnecting bulk supply points.

Oxford. — SWITCHGEAR. — The Town Council is recommended to apply for sanction to borrow £2,140 for the purchase of heavy switchgear.

Salford.—ELECTRICITY FOR BLACK-OUT ROOMS.—Domestic consumers who have had to have their windows boarded up as a result of enemy action are to receive their supplies under the cheaper tariff already available for larger consumers.

LARGE POWER SUPPLIES.—The Corporation Light, Heat and Power Committee recommends an increase in the running charge under the two-part rate for power and heating for large consumers from 0.25d. to 0.275d. per kWh for all energy exceeding 250,000 kWh per quarter.

STREET LIGHTING.—The Town Council has decided to extend the modified lighting on nine main roads.

Scarborough.—SUBSTATION EXTENSIONS.—The Town Council is applying to the Electricity Commissioners for sanction to borrow £655 for substation extensions.

Shropshire.—BATTERY LIGHTING FOR SHELTERS.—The County Council Emergency Committee has authorised the county architect to install battery lighting sets at an estimated cost of £12 per trench for 50, or £16 per unit for two trenches, in certain school trenches. An estimate of £315 for auxiliary lighting in public shelters has also been approved.

Southport.—AID FOR RAID VICTIMS.—It was mentioned at a meeting of the Town Council that some towns had decided to reduce charges for lighting to people who were compelled to use artificial light all day as a result of having their windows boarded up after raid damage. The Electricity Committee was doubtful of the legality of this concession and the Town Clerk has been asked to ascertain how the other towns have "got round the regulations."

Stoke-on-Trent.—DUPLICATE SUPPLY.—The Corporation Emergency Committee has arranged for the Electricity Department to provide an additional electricity supply at the Cauldon depot, at a cost of £137.

Sunderland. — SCHOOL INSTALLATIONS. — The Education Committee has approved the spending of £11,713 on the installation of lighting and heating in school shelters.

Surrey.—ELECTRICITY CHARGES FOR WARDENS' POSTS.—Complaints have been received by the London and Home Counties Joint Electricity Authority from a number of local authorities regarding the charges made for lighting and heating the wardens' posts. The Authority is treating each of the posts as a separate "business," the cost in the rural areas being said to work out at over £4 per quarter or over 2¾d. per kWh. Supplies to posts in adjacent areas by the County of London Electric Supply Co., Ltd., it is stated, cost about £1 12s. per post per quarter, or only just over 1d. per kWh. Formal protests by the Banstead and Epsom Councils have been rejected and the Banstead Council is to carry the matter further by approaching the Electricity Commissioners.

Watford.—UNDERTAKING UNAFFECTED BY WAR.—In his report on the operation of the Corporation electricity undertaking for the year ended March 31st last, Mr. A. W. Barham, the chief engineer and general manager, says that, generally speaking, the undertaking has not been affected by war conditions to any great extent, except by the operation of the lighting restrictions and the inevitable increases in the cost of labour and materials. Sales of energy at 74,149,671 kWh represent an increase of 7 per cent. over the preceding year and more than 18 per cent. over 1937-38. The overall average price per kWh sold has fallen by 0.03d. from the 1938-39 figure of 0.89d. The gross revenue rose from £260,211 to £271,121 and the working expenditure from £174,619 to £187,699, the net surplus being £30,225, as against £32,523. A further 1,696 consumers were connected during the year, making a total of 31,832.

West Hartlepool.—PROPOSED INQUIRY REJECTED.—The Town Council has rejected a proposal to hold a second inquiry into allegations concerning the electricity undertaking. At a meeting of the Council, Councillor W. T. Pinkney asked that an unreported minute from a special committee approved by the Electricity Committee be read in open Council. He alleged that the first inquiry had not been held properly and suggested that a further subcommittee be appointed to investigate the charges made. Alderman G. W. Turnbull seconded. Councillor Bloom, chairman of the Electricity Committee, opposed the proposal. He said that the charges made were found to be untrue. If the Council wished for another inquiry he would ask for a proper court of inquiry with evidence taken on oath, when there would probably be an action for defamation of character.

Wishaw.—SUBSTATION.—The Dean of Guild Court has approved of plans for the erection of a substation by the Town Council at a cost of £500.

Wolverhampton.—LIGHTING OF SCHOOL SHELTERS.—The installation of electric lighting in school shelters at an estimated cost of £2,000 is recommended by the Education Committee.

EXTENSIONS.—The Corporation Electricity Committee is to provide a supply to Lea Manor, Albrighton, at a cost of £123.

Wootton.—OVERHEAD LINES EXTENSIONS.—The Isle of Wight Electric Light & Power Co., Ltd., is to extend overhead lines.

I.M.E.A. Notes

Coal Price Increases

THE February *I.M.E.A. Journal* refers to the rapid increase in the price of coal during the past year or two and says that this is a source of continued anxiety to electricity supply undertakings. It has necessitated increases in the charges for electricity amounting in some cases to as much as 25 per cent. Incidentally, the Secretary for Mines stated recently in the House of Commons that he knew of no increases in coal prices which would have justified a 25 per cent. increase in electricity charges.

The I.M.E.A. has made a further protest to the Mines Department and members are urged to communicate with their Members of Parliament to secure their support against the continual increases.

Rationing Forms Dispute

When it was decided not to proceed with the rationing of electricity many supply undertakings found themselves with large numbers of unwanted forms which they had had printed for the purpose. It was originally assumed that the expense of these forms would be reimbursed by the Mines Department, but, apparently, the Department is reluctant to meet the cost. In reply to representations made by the I.M.E.A. the Department has stated that if rationing is imposed the work already done will be found of value and payment at the agreed rate will then be made. If, however, rationing is not proceeded with "the expenditure incurred by the undertakings for work not carried to completion may require to be considered and discussed between the Department and the undertakings concerned."

The Council is taking the matter up with the Mines Department protesting against this attitude and asking the Treasury to refund the amount expended by them without waiting for the reimposition of a rationing scheme.

War Damage Scheme

It is stated that the Joint Committee of Electricity Supply Associations has been enlarged by the appointment of an additional four members—two from the I.M.E.A. and one each from the Incorporated Association of Electric Power Companies and the Provincial Electric Supply Association. Messrs. E. E. Hoadley and R. Birt are the new I.M.E.A. representatives. The Joint Committee has the question of war damage to electrical undertakings under constant consideration and a pronouncement will be made as soon as possible. The Committee has discussed the subject with the Electricity Commissioners and has made certain suggestions regarding the Government scheme.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specifications (1s. each) can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1939

15108. "System for producing television images in natural colour." Cosmocolor Corporation. May 21st, 1938. (532382.)

17959. "Electric power cables." Standard Telephones & Cables, Ltd. and T. R. Scott. June 20th, 1939. (532384.)

18711. "Electric lamp sockets or the like." W. J. P. Stonehouse. June 29th, 1938. (532385.)

19049. "Apparatus for treating mixtures of gases, vapours, or fumes with electric discharges." A. W. Dye. June 30th, 1939. (532311.)

20099. "Sealing of tungsten objects into glass." Philips Lamps, Ltd. July 13th, 1938. (532451.)

20319. "Testing of electric ignition systems for internal combustion engines." British Thomson-Houston Co., Ltd., L. Darke and W. H. Maycock. July 12th, 1939. (532312.)

20799. "Electrical surge-absorbers." Ferranti, Ltd., and J. L. Miller. July 18th, 1939. (532246.)

20869. "Electrical condensers." Standard Telephones & Cables, Ltd., and P. W. Larsen. July 18th, 1939. (532248.)

20871. "Thermionic valve circuits and gain controls therein." Standard Telephones & Cables, Ltd., D. S. B. Shannon and P. K. Chatterjea. July 18th, 1939. (532249.)

20872. "Electron discharge devices." Standard Telephones & Cables, Ltd., and W. A. Windsor. July 18th, 1939. (532250.)

20987. "Light signals of the searchlight type." Westinghouse Brake & Signal Co., Ltd. March 29th, 1939. (532252.)

21005. "Absorption refrigerating apparatus." Hoover, Ltd. July 20th, 1938. (532257.)

21006. "Refrigerating - apparatus." Hoover, Ltd. July 20th, 1938. (532324.)

21059. "Photo - electrically sensitive electrodes." Baird Television, Ltd., and A. Sommer. July 20th, 1939. (532259.)

21099. "Thermionic valve systems." Telephone Manufacturing Co., Ltd., and L. H. Paddle. July 20th, 1939. (532326.)

21111. "Electromagnetic relays for railway signalling systems." Westinghouse Brake & Signal Co., Ltd. February 23rd, 1939. (532263.)

21237. "Electric heating apparatus suitable for cooking and other purposes." A. F. Berry. July 21st, 1939. (532391.)

21250. "Systems for the electric transmission of signals over wires." Standard Telephones & Cables, Ltd., B. B. Jacobson, A. H. Roche and V. J. Terry. July 21st, 1939. (532523.)

21251. "Electric frequency testing." Standard Telephones & Cables, Ltd., R. M. Barnard, R. McCloghrie and O. S. Higher. July 21st, 1939. (532392.)

21411. "Methods of manufacturing mosaic electrodes." Baird Television, Ltd., and K. A. R. Samson. July 24th, 1939. (532525.)

21713. "Electric switches particularly for use on alternating current circuits." C. L. Arnold and M. K. Electric, Ltd. July 26th, 1939. (532336.)

21851. "Thermionic valve circuits." Siemens Bros. & Co., Ltd., and P. A. Chittenden. July 27th, 1939. (532337.)

22336. "Bonding clamps for use with electrical cables." Aero Engines, Ltd., and P. Sykes. August 1st, 1939. (532344.)

22524. "Electrical ciphering machine." G. W. Ogden. August 3rd, 1939. (532345.)

23145. "Electric relays." T. L. H. Butterfield and Metropolitan-Vickers Electrical Co., Ltd. August 10th, 1939. (532540.)

24075. "Ionic valves with metal vessels." Allmanna Svenska Elektriska Aktiebolaget. August 27th, 1938. (532541.)

24292. "Electric discharge devices and the manufacture thereof." British Thomson-Houston Co., Ltd. August 23rd, 1938. (532270.)

24314. "Direct-current electric power transmitting apparatus with current converting devices at the ends of the transmission line." Patentverwertungs Ges. Hermes. August 23rd, 1938. (532273.)

24335. "Electric remote control systems." M. & C. Switchgear, Ltd., and F. B. Richardson. August 24th, 1939. (532277.)

24343. "Means for securing conduits to electrical junction boxes and the like." Conduit Fittings, Ltd., J. Hockham and J. Smith. August 24th, 1939. (532278.)

24344. "Electrical junction boxes, switch boxes and the like." Conduit Fittings, Ltd., J. Hockham and J. Smith. August 24th, 1939. (532279.)

24372. "Lamp grip devices for lamp holders and like electrical connecting means." G. Campbell and Benjamin Electric, Ltd. August 24th, 1939. (532284.)

24382. "Circuit arrangements for the control of motors serving as individual drive of selectors in telephone or like selective systems." Siemens Bros. & Co., Ltd. (Fides. Ges. für die Verwaltung and Verwertung von Gewerblichen Schutzrechten.) August 24th, 1939. (532286.)

24383. "Telephone systems." Siemens Bros. & Co., Ltd., and E. Colley. August 24th, 1939. (532287.)

24475. "Electrical measuring instruments." Westinghouse Electric International Co. August 25th, 1938. (532297.)

24509. "Electric wave translation systems." Standard Telephones & Cables, Ltd. October 7th, 1938. (532302.)

24524. "Extinguishing chamber with differential piston for electric circuit breakers." D. Ronnberg and Allmanna Svenska Elektriska Aktiebolaget. August 25th, 1939. (532303.)

24581/2. "Elastic fluid turbines." British Thomson-Houston Co., Ltd. August 27th, 1938. (532357/8.)

24706. "Elastic fluid turbines." British Thomson-Houston Co., Ltd. August 27th, 1938. (532372.)

24708. "Elastic fluid turbines." British Thomson-Houston Co., Ltd. August 27th, 1938. (532373.)

24710. "Electric metering systems." British Thomson-Houston Co., Ltd. August 27th, 1938. (532374.)

24793. "Electric switching devices especially for current rectifiers." British Thomson-Houston Co., Ltd. August 29th, 1938. (532410.)

24794. "Anode structures for short-wave electric discharge devices." British Thomson-Houston Co., Ltd. August 29th, 1938. (532411.)

24815. "Fuses for electric circuits." Philips Lamps, Ltd. September 1st, 1938. (532413.)

24837. "Photoelectric apparatus." D. Broido. August 29th. 1939. (Cognate application, 27380/39.) (532416.)

24889. "Electric insulating material." British Thomson-Houston Co., Ltd. August 31st, 1938. (532425.)

24890. "Doors of refrigerator cabinets." British Thomson-Houston Co., Ltd. August 30th, 1938. (532426.)

24891. "Centrifugal governor mechanism." British Thomson-Houston Co., Ltd. (Allgemeine Elektricitätsges.) August 30th, 1939. (532427.)

24916. "Alternating current relay devices." Sangamo Weston, Ltd., and G. F. Tagg. August 30th, 1939. (532429.)

24948. "Motor control systems employing variable voltage transformers." Vickers, Inc. August 31st, 1938. (532434.)

25000. "Heat responsive devices." Sangamo Weston, Ltd. March 30th, 1939. (532440.)

25001. "Time-element electric relays." General Railway Signal Co. October 14th, 1938. (532441.)

25007. "Apparatus for measuring earth resistances." Fides Ges. für die Verwaltung und Verwertung von Gewerblichen Schutzrechten. August 31st, 1938. (532476.)

25009. "Electric gas blast switches." British Thomson-Houston Co., Ltd. August 31st, 1938. (532477.)

25010. "Centrifugal speed governors." British Thomson-Houston Co., Ltd. August 31st, 1938. (532478.)

25011. "X-ray apparatus." British Thomson-Houston Co., Ltd. September 1st, 1938. (532479.)

25069. "Methods of making hard sintered alloys." British Thomson-Houston Co., Ltd. September 1st, 1938. (532486.)

25070. "Electrical insulating materials." British Thomson-Houston Co., Ltd. September 1st, 1938. (532487.)

25074. "Elastic fluid turbines." British Thomson-Houston Co., Ltd. September 2nd, 1938. (532488.)

25075. "Magnetic cores for transformers or the like." British Thomson-Houston Co., Ltd. September 3rd, 1938. (532489.)

25077. "Bimetallic thermal electric switches." British Thomson-Houston Co., Ltd. September 3rd, 1938. (532490.)

25078. "Governing mechanisms for turbines." British Thomson-Houston Co., Ltd. September 3rd, 1938. (532491.)

25126. "Sources of light comprising an electric discharge device and luminescent material." General Electric Co., Ltd. (Patent-Treuhand-Ges. für Elektrische Gluhlampen.) September 1st, 1939. (532501.)

25127 "Means for subjecting matter to a high-frequency electromagnetic field." General Electric Co., Ltd., and E. C. S. Megaw. September 1st, 1939. (532502.)

25236. "Electrical signalling systems." General Electric Co., Ltd., and J. Scowcroft. September 7th, 1939. (532514.)

25256. "Electric lampholders and like devices." G. Campbell and Benjamin Electric, Ltd. September 7th, 1939. (532550.)

25272. "Rectifying circuits." Philips Lamps, Ltd. September 6th, 1938. (532551.)

25273. "Dynamo-electric machines." Philips Lamps, Ltd. September 9th, 1938. (532552.)

25338. "Electric motors." Lancashire Dynamo & Crypto, Ltd., and P. Huggins. September 7th, 1939. (532560.)

25422. "Electric circuit controlling devices, particularly for refrigerators." General Motors Corporation. September 15th, 1938. (532576.)

25454. "Lantern fittings." British Thomson-Houston Co., Ltd., J. Bertram, R. Maxted and F. W. Thorpe. September 8th, 1939. (532445.)

25830. "Electrical contact members." Westinghouse Electric International Co. September 14th, 1938. (532447.)

FINANCIAL SECTION

Company News. Liquidations and Bankruptcies. Stock Exchange Activities

Reports and Dividends

The English Electric Co., Ltd., has now issued its accounts for the year ended December 31st which confirm the preliminary figures already published. The trading profit, after providing for taxation, was £517,066, as compared with £484,215 for 1939. Debenture interest absorbs £48,122, fees £5,208 and depreciation £100,000, leaving a net profit of £363,736 (£355,656). Reserve again receives £100,000 and the ordinary dividend for the year is maintained at 10 per cent., less tax. The balance carried forward is £54,495 (against £56,840 brought in).

The Westinghouse Brake & Signal Co., Ltd., held its annual meeting on February 11th, when Lord Southborough (chairman), who presided, said that shareholders would appreciate his reasons for not giving the usual detailed account of the company's activities, but he could say that the whole of its energies were being fully and vigorously employed. Their subsidiary companies were domiciled within the British Empire and they had all made profits during the past year. The companies associated with them were domiciled on the Continent, and they had taken care to protect themselves as far as possible against loss and damage. In 1937 the board placed £78,000, received from the realisation of part of the assets of an associated company, which was voluntarily liquidated, to a reserve for investments. As a result of that liquidation they received the shares in certain of these associated Westinghouse companies situated on the Continent of Europe. This reserve had proved of great value and with a further £13,293, taken from the profits of the year under review, enabled them to make a full reserve against the value of their shareholdings in the associated companies.

Capt. B. H. Peter (managing director) said that such time as could be spared from their direct war effort was being spent first on doing their best to keep up their export trade. That was helping to provide the much-needed foreign exchange at the present time, and helping to keep the markets for the difficult times which would inevitably follow the war. The other factor they had in mind was their development work, which at the present time had to be much reduced. Wherever they could, however, they would keep it going for the benefit of the company after the war was over.

The Power Securities Corporation, Ltd., reports a net revenue of £48,973 for 1940, as compared with £75,897 for the preceding year. The ordinary dividend is reduced from 7 to 6 per cent., and £18,704 is carried forward (against £17,456 brought in).

The Bognor Gas & Electricity Co. has announced a final ordinary dividend of 4 per cent., making 8 per cent. for the year (same).

The Rheostatic Co., Ltd.—Presiding at the annual meeting on February 11th, **Mr. L. Satchwell (chairman)** said that the company's normal products were still in great demand, including for export, though some markets were now, of course, closed. The position of their Continental subsidiaries was obscure, but their investment reserve of £8,000 substantially provided for any losses which might be incurred.

The Northampton Electric Light and Power Co., Ltd., proposes to pay a final dividend on the ordinary stock of 6 per cent., again making 10 per cent., less tax, for the year. The net profit for 1940 amounted to £137,485, as compared with £110,833 for the preceding year.

The Rushden & District Electric Supply Co., Ltd., reports net profits for 1940 of £13,892, as compared with £11,013 for 1939. The final dividend is 5 per cent., maintaining the distribution for the year at 9 per cent.

Peter Brotherhood, Ltd., have declared an interim ordinary dividend of 8 per cent. (same).

The London Electric Supply Corporation, Ltd., is paying a final ordinary dividend of 4 per cent., making 7 per cent. for the year to December 31st.

Mather & Platt, Ltd., report a net profit for the year to December 31st of £159,703, as compared with £146,867 for 1939. The ordinary dividend for the year is maintained at 10 per cent. and £76,857 is carried forward (against £73,520 brought in).

The Bristol Tramways and Carriage Co. proposes to pay a final dividend of 4 per cent., less tax (against 4 per cent. tax free.)

New Companies

Cable Accessories Co., Ltd.—Private company. Registered February 6th. Capital £1,000. Objects: To carry on the business of manufacturers of, and dealers in, cables, chains, anchors, belts, wires, cords, conductors, turbines, boilers, dynamos, mechanical and electrical machinery, plant and fittings; to lay cables, mains and conductors, etc. Directors: G. Lounsbach (chairman) and Mrs. J. Lounsbach, both of The Hollies, Clifton Junction, Lancs. Solicitors: Crofton, Craven and Co., 36, Brazennose Street, Manchester.

Mullard Horticultural Engineering Co., Ltd.—Private company. Registered January 31st. Capital £500. Objects: To carry on the business of horticultural and agricultural engineers, manufacturers of, and dealers in, implements, tractors, plant, tools, accessories, heating, lighting, sterilising and irrigating systems and apparatus, etc. Directors: S. R. Mullard, Pantiles Cottage, Englefield Green, Egham, Surrey (director of Mullard Radio Valve Co., Ltd.), and Mrs. E. G. W. Mullard, same address. Registered office: Bakeham Lane, Englefield Green, Egham, Surrey.

Richmond Engineering Co., Ltd.—Private company. Registered February 8th. Capital £1,000. Objects: To carry on the business of mechanical, electrical, marine and general engineers, manufacturers of, and dealers in, machinery, rolling stock, tools, accessories, hardware and engineering equipment, motor vehicle and cycle manufacturers, etc. Directors: W. E. Slade, 31, St. Agnes Road, St. Paul's, Bristol, 2; H. G. Pettitt, 38, Royal Albert Road, Westbury Park, Bristol, 6; A. E. Groves and E. M. Groves, both of 43, Balmoral Road, St. Andrews, Bristol, 7; S. B. Groves, 111, Smythe Road, Ashton Gate, Bristol, 3; and F. Provis, 74, Chelsea Park, Easton, Bristol, 5. Registered office: Richmond Road, St. George, Bristol.

Companies' Returns

Statements of Capital

Kye Electrical, Ltd.—Capital £25,000 in 20,000 preference shares of £1 and 100,000 ordinary shares of 1s. Return dated October 11th, 1940. 12,502 preference and 92,500 ordinary shares taken up. £17,127 paid. Mortgages and charges: Nil.

La Plata Electric Tramways Co., Ltd.—Capital £450,000 in 200,000 preference and 250,000 ordinary shares of £1 each. Return dated November 13th, 1940. All shares taken up. £170,007 paid on 170,007 preference. £279,993 considered as paid on 29,993 preference and 250,000 ordinary. Mortgages and charges: £78,300.

David Rowan (Vidro), Ltd.—Capital £7,500 in 3,250 ordinary, 1,750 10 per cent. preference and 2,500 6 per cent. "A" preference shares of £1. Return dated August 13th, 1940. 3,250 ordinary, 1,186 10 per cent. preference and 900 "A" preference shares taken up. £2,836 paid on 750 ordinary, 1,186 10 per cent. preference and 900 "A" preference. £2,500 considered as paid on 2,500 ordinary shares. Mortgages and charges: Nil.

L. Nicholson & Co., Ltd.—Capital £6,000 in £1 shares. Return dated August 1st, 1940. 4,550 shares taken up. £952 paid. £3,598 considered as paid. Mortgages and charges: Nil.

Private Arrangement

E. H. Tawn, trading as Clive & Co., electrical factor, 26, Curzon Street, Derby.—At a recent meeting of creditors a statement of affairs was submitted showing liabilities of £617, of which £417 was due to the trade and the balance of £200 to a cash creditor. There were also fully secured creditors for £1,009, who held charges on two houses which, for the purposes of the statement of affairs had been valued at the amount outstanding. The net assets were £532, leaving a deficiency of £85.

It was reported that in recent months the trading had declined and the debtor considered it advisable to consult his creditors. He did not desire to continue the business. It was resolved that the estate should be realised under a deed of assignment to Mr. A. Forsyth, of J. Sibbald Forsyth & Farnsworth, Derby, and Mr. F. E. Bendall, of Poppleton & Appleby, Birmingham, as joint trustees. A committee of three of the creditors was also appointed.

Bankruptcies

H. Rose, electrical dealer, trading as Rose Electrical Services, 158, Soho Road, Handsworth, Birmingham.—The first meeting of creditors was held recently at the Official Receiver's Office, Somerset House, 37, Temple Street, Birmingham, when it was reported that the liabilities totalled approximately £750 against assets estimated at £600. A resolution was passed appointing Mr. F. E. Bendall, of Poppleton & Appleby, Birmingham, as trustee.

A. W. Schofield, 24, Balmoral Drive, Denton, and **D. Tanner,** 118, Hyde Road, Denton, formerly trading in partnership as Schofield & Tanner, registered electrical and radio engineers, at 673, Manchester Road, Denton, Lancs.—Last day for receiving proofs for dividend February 25th. Trustee, Mr. F. E. Bendall, 31, Lloyd Street, Albert Square, Manchester.

H. Truett, electrician, 13, Elmwood Avenue, Baldock, Herts.—Public examination February 21st, at the Sessions House, Lincoln.

T. P. Wood and **T. George** (T. P. Wood), electrical contractors, 28, Queen Street, Ipswich.—First dividend of 1s. 6d. in the £, payable February 22nd at 13A, Great Colman Street, Ipswich.

STOCKS AND SHARES

TUESDAY EVENING.

THE Government has announced that the basis of national borrowing is to be 3 per cent. For some time past this intention has been obvious to those who study the position as it has developed during the war, but its official recognition gives a fresh reason for the firmness of all gilt-edged securities. By way of contrary influence, the Treasury has given notice of a Vesting Order for the requisition of half a dozen issues of the Government of India to which specific later dates of repayment are attached.

The industrial markets as a whole are quiet. The extra hour of business afforded by the Stock Exchange remaining open until three o'clock in the afternoon, has merely accentuated the tedium of listless days. Dividends on electrical stocks and shares are giving satisfaction in practically every case. The general tendency of Stock Exchange markets was coloured, at the end of last week, by the bellicose attitude of Japan.

Home Railway Dividends

On the Wednesday in this week the Home Railway companies are expected to declare their dividends in respect of the year 1940. In advance, it was assumed that most of the fixed interest stocks would receive their full dividend. From the fact of Southern Railway 5 per cent. preferred, for example, standing at 48½, it is obvious that a little doubt existed. Whatever this week's dividends may show, a feeling of uncertainty will remain as to what is likely to happen in the future.

On several previous occasions, attention has been drawn here to a growing theory that there may be some modification at an early date of the financial arrangements made a year ago between, on the one hand, the Minister of Transport and, on the other, the four amalgamated railway companies, plus the London Transport Board. Those arrangements provided for the Government to take over the companies as from September 1st, 1939. The revenue, receipts and expenses of the controlled undertakings were to be pooled, and the resultant net revenue for each accounting period was to be appropriated in accordance with the arrangements made between the parties. The L.P.T.B. was to receive 11 per cent. of the guaranteed payments from the Government, the guarantee amounting approximately to £40 million, which would be divided amongst the five undertakings.

So many things have happened during the past twelve months that some alteration in the agreement could scarcely have been avoided. Until the new plan is published and agreed, holders of Home Railway stocks will scarcely know how their interests stand. Prices of the principal stocks have been disposed to give way after their previous sharp rises, and speculators who had bought on dividend expectations have been taking profits here and there, and refraining from entering into fresh commitments.

Cable and Wireless

Cable and Wireless stocks are holding their ground with tenacity. Business in the securities has fallen off to a large extent, but this is not allowed to disturb the prices of the preference and ordinary stocks; the latter is 10s. up, at 54. The financial year ends with December; the dividend announcements come in May. Anticipation looks for the dividend on the ordinary stock to be maintained at the previously paid 4 per cent. Earnings will probably indicate that a much more substantial distribution could be made.

Cable and Wireless is interested mainly in the three cable companies, Eastern, Eastern Extension and Western Telegraph, and in the Marconi undertakings. Presumably these concerns have done well during the past twelve months, but it is not thought that the dividend on Cable and Wireless ordinary will be increased. At the current price of the stock, the return comes to nearly 7 per cent. The dividend on this issue is paid once a year. The preference at 95½ gives 5¾ per cent.

Price Fluctuations

The sweeping success of our forces in Libya has had the effect of putting up East African Power shares by 2s. 6d. to 25s. Notting Hill preference were marked down 10s. to 8½ on a mild pressure to realise a few shares. Southern Areas have come into demand; the price was lifted to 16s. 3d. Provincial shares are again in persistent request. This has resulted in rises in Llanelly, North Eastern, and Yorkshire ordinary.

In the equipment and manufacturing group, Joseph Lucas advanced to 55s. and Automatic Telephones to 46s. 3d. Globe Telegraph and Trust preference, at 27s. 6d., are $\frac{1}{16}$ up, coming into line with the ordinary. The dividend on the latter is, however, paid free of tax. Babcock & Wilcox receded to 41s. 3d. Vickers have lost 6d. at 14s. 9d.

English Electric

The experience of the English Electric Company is one which will be achieved in a good many reports and balance sheets during the next few months. The company's trading profit showed an increase of £32,800 and the net profit is £8,000 up. The ordinary dividend is maintained at 10 per cent. The bank overdraft of £483,000 is £300,000 higher than in the previous accounts, the increase being due to the need for financing additional orders. The price of the shares is 30s. ex dividend of 2s. per share gross; the yield on the money comes to £6 13s. 4d. per cent.

Power Securities

The Power Securities Corporation announces its net revenue for the year to December 31st last as £48,973, a reduction of £37,000 as compared with that of the previous twelvemonth. The company is paying a dividend of 6 per cent. as against 7 per cent. in each of the past ten years. Power Securities Corporation owns all the shares of Balfour, Beatty & Co., Ltd. It controls the Hydro-Electric Development Co., Ltd., and the Metropolitan Construction Co., Ltd. Mr. George Balfour, M.P., J.P. is the chairman. The report shows the diminution in revenue to be due to war conditions. The company has a substantial Italian interest, the value of which has been written down to £480,300, which still looks a large sum.

In these days, the earnings of a company dealing with general finance business such as that of the Power Securities Corporation, are bound to be unfavourably affected. The ordinary shares of £1 each are quoted at 15s. ex the dividend of 1s. 2⅜d.

Ordinary v. Preference

The Northampton Electric Light & Power Co. has declared a final dividend for last year on the ordinary stock of 6 per cent., making 10 per cent. for the year, the same as that paid previously. The profits of £137,400 are nearly £47,000 up. These figures, following upon those recently published by the Yorkshire Electric Co., are sufficiently good to emphasise the impression that the Provincial electricity supply companies will maintain their previous distributions; for this reason, the market in the shares is decidedly firm. There is, however, not quite the same keenness of appetite for the ordinary shares as for the preference in these companies. It is contended, naturally, that upon the ordinary shares falls the burden of whatever loss may be sustained by war conditions. But taking all this into consideration, the investor is content to buy ordinary shares up to a level of prices which, as our list of quotations shows, give yields ranging from 4¾ to 5½ per cent. on the money.

The electric lighting and power companies have been so far extremely fortunate in escaping most of the worst effects of the air raids. Not long ago, it was proposed that supply authorities should form a guarantee fund amongst themselves to provide against possible loss by damage, but the Government's scheme for compulsory insurance of war risks, shortly to be introduced, will supersede this. The previous plan, therefore, is, for the time being at any rate, laid upon the shelf.

Electricity Authority Stocks

The latest step in requisitioning securities has been taken by the Treasury in order to further the war effort, but it has made holders of other stocks to which dates are affixed a little apprehensive as to whether they may not be called upon to hand over their investments before the dates applicable to the loans' repayment. For instance, the seven issues of the Central Electricity Board which are known to the London market all have dates at which they will have to be repaid. The same arrangement applies to most of the other electricity supply board securities which are dealt in by the Stock Exchange.

It is asked whether the action of the Treasury may be extended to securities other than those of the Government of India. For the reassurance of such inquirers, it may be of service to point out that only in the case of a stock which bears any relation to the need for foreign exchange is there any likelihood of the Treasury requisitioning powers being exercised.

ELECTRICAL COMPANIES' SHARES

Prices, Dividends and Yields

Company	1940 Highest	1940 Lowest	Dividend Previous	Dividend Last	Middle Price Feb. 17	Rise or Fall	Yield £ s. d.
Home Electricity Companies							
Bournemouth and Poole	63/6	36/6	15	15	47/6	..	—
British Power and Light	30/-	20/-	7	7	26/6	−6d.	5 3 8
City of London	28/-	20/-	7½	7½	21/3	..	—
Clyde Valley	38/6	24/-	8	8	35/-	..	4 11 5
County of London	43/3	21/-	10½	10½	32/6	..	6 9 3
Edmundson's:							
7% Pref.	32/-	24/3	7	7	28/3	..	4 19 1
Ord.	27/6	18/6	9	6	24/6	..	4 18 0
Elec. Dis. Yorkshire	40/3	32/-	9	9	36/3	..	4 19 4
Elec. Fin. and Securities	42/-	34/6	12½	12½	40/-	..	6 5 0
Elec. Supply Corporation	48/-	39/-	12	11½	37/-	..	6 4 4
Isle of Thanet	16/-	5/6	4	4	6/-	..	—
Lancs Light and Power	33/-	21/6	7½	7½	28/9	..	5 4 4
Llanelly Elec.	21/-	17/-	5½	5½	20/-	+1/-	5 10 0
Lond. Assoc. Electric	21/-	12/6	7	5½	13/9	..	—
London Electric	35/-	19/-	8	7	21/3	..	6 11 9
London Power Deb. Red	105½	100	5	5	104½	..	4 15 6
Metropolitan	41/6	22/6	12	10	33/9	..	5 18 6
Midland Counties	39/-	23/3	8	8	33/9	..	4 14 10
Mid. Elec. Power	40/-	29/6	9	9	33/9	..	5 6 8
Newcastle Elec.	29/9	22/6	7	7	25/-	..	5 12 0
North Eastern Elec.:							
Ordinary	31/6	16/6	7	7	27/-	+9d.	5 3 9
7% Pref.	32/6	25/6	7	7	30/-	..	4 13 4
Northampton	44/-	38/-	10	10	40/-	..	5 0 0
Notting Hill 6% Pref. (£10)	10½	9	6	6	8½	−½	—
Northmet Power:							
Ordinary	42/3	22/6	10	10	32/6	−9d.	—
6% Pref.	29/-	23/-	6	6	28/-	..	4 5 9
Richmond Elec.	24/6	18/-	7	6	18/9	..	—
Scottish Power	38/-	24/-	8	8	34/6	..	4 12 9
Southern Areas	21/3	12/9	5	5	16/3	+⅛	6 3 1
South London	23/3	20/-	7	7	20/-	..	7 0 0
West Devon	20/-	17/6	5	5	20/-	..	5 0 0
West Glos.	22/-	15/-	2½	4½	16/3	..	5 10 10
Yorkshire Elec.	40/-	23/6	8	8	35/9	+9d.	4 9 5
Overseas Electricity Companies							
Atlas Elec.	4/-	1/3	Nil	Nil	2/-	..	—
Calcutta Elec.	37/-	22/6	10*	8*	35/-	..	4 11 5
Cawnpore Elec.	30/-	24/-	10	10	27/6	..	7 5 6
East African Power	25/6	19/6	7	7	25/-	+½	5 12 0
Jerusalem Elec.	24/-	15/-	7	7	21/3	..	6 11 9
Kalgoorlie (10/-)	12/6	9/6	7½	7½	12/-	..	6 5 0
Madras	26/9	21/6	8*	6*	25/-	..	—
Montreal Power	35½	30	1½	1½	29½	−1½	—
Palestine Elec. "A"	25/-	10/-	5*	Nil	20/-	..	—
Perak Hydro-electric	20/3	13/-	2½	6	17/-	..	7 1 2
Shawinigan Power	27½	19	83cts.	90cts.	18½	..	—
Tokyo Elec. 6%	69	30	6	6	40½	+2	14 16 4
Victoria Falls Power	75/9	56/6	15	15	72/6	..	4 2 9
Whitehall Investments Pref.	17/9	8/-	7½	7½	14/6	..	10 6 10
Public Boards							
Central Electricity							
1950-70	110½	104	5	5	109	..	4 11 9
1955-75	112½	106	5	5	112	..+1	4 9 3
1951-73	107½	102	4½	4½	107	..+1	4 4 0
1963-93	96½	90	3½	3½	95	..	3 13 6
1974-94	91	79½	3½	3½	88½	..	3 13 5
London Elec. Trans. Ltd.	92	87½	2½	2½	93	..	2 15 9
London & Home Counties							
1955-75	113¼	105	4½	4½	105½	..	4 5 4
Lond. Passenger Transport							
A	116	104	4½	4½	111½	..	4 0 9
B	116	102½	5	5	106	..	4 14 4
C	65½	25	1½	1½	34	..	4 8 3
West Midland Joint Elec.							
1948-68	106½	103	5	5	105½	..	4 14 9
Telegraph and Telephone							
Anglo-Am. Tel.:							
Pref.	107	85	6	6	101½	+½	5 18 3
Def.	23¾	18	1½	1½	23½	..	6 7 8
Anglo-Portuguese	22/6	10/-	8	8	15/-	..	10 13 4
Cable & Wireless:							
5½% Pref.	99¾	66	4½	5½	95½	..	5 15 2
Ord.	65	27	4	4	54	+½	7 8 2
Canadian Marconi $1	6/-	4/-	Nil	4cts.	5/-	..	—
Globe Tel. & Tel.:							
Ord.	32/6	21/6	7½*	6*	27/6	..	4 7 3
Pref.	27/9	22/6	6	6	27/6	+⅛	4 7 3
Great Northern Tel. (£10)	20	11	20	20	12½	..	—
Inter. Tel. & Tel.	5½	2½	Nil	Nil	3	..	—
Marconi-Marine	30/-	18/3	10	7½	22/6		6 13 3
Oriental Telephone Ord.	2⅞	45/-	12*	11½*	2⅜	..	4 16 10
Telephone Props.	15/-	11/-	6	6	11/3	..	10 13 4
Telephone Rentals (5/-)	9/6	5/3	10	10	7/3	..	18 0

Company	1940 Highest	1940 Lowest	Dividend Previous	Dividend Last	Middle Price Feb. 17	Rise or Fall	Yield £ s. d
Traction and Transport							
Anglo. Arg. Trans:							
First. Pref. (£5)	4/3	1/-	Nil	Nil	2/-	..	—
4% Inc.	11½	2	Nil	Nil	6½	..	—
British Electric Traction:							
Def. Ord.	830	400	5	45	800	..	5 12 6
Pref. Ord.	169	130	8	8	150	..	5 6 8
Bristol Trams	48/6	32/6	10	8*	38/9	..	—
Brazil Traction	12½	5½	$1	50c.	7	..	—
Calcutta Trams	24/-	16/3	8	5½	19/-	..	5 15 8
Cape Elec. Trams	18/6	16/-	5	5	17/-	..	5 17 4
Lancs Transport	35/-	27/6	10	10	35/-	..	5 14 3
Mexican Light:							
1st Bonds	36	25	5	5	35	..	—
Rio 5% Bonds	95	74	5	5	85	..	5 17 8
Southern Rly.:							
5% Prefd.	79	35	5	5	48½	−1	10 6 0
5% Pref.	104½	59	5	5	87	..	5 15 0
T. Tilling	45/9	29/-	10	10	41/3	−⅛	4 17 0
Tilling & B.A.	47/6	41/9	9*	8*	44/6	..	—
West Riding	35/-	25/-	10	10	34/6	..	5 16 0
Equipment and Manufacturing							
Aron Electricity Ord.	17/6	10/-	15	Nil	16/-	..	—
Assoc. Elec.							
Ord.	43/3	26/6	10	10	40/-	..	5 0 0
Pref.	36/6	32/3	8	8	35/-	..	4 11 5
Automatic Telephone & El.	47/3	32/-	12½	12½	46/3	+⅛	5 8 1
Babcock & Wilcox	50/-	28/6	10	11	41/3	−⅛	5 6 6
British Aluminium Ord.	56/-	29/-	12½	12½	42/-	..	—
British Insulated Ord.	92/6	67/-	20	20	83/9	−⅛	4 15 6
British Thermostat (5/-)	14/9	6/6	18½	18½	11/3	..	8 4 6
British Vacuum Cleaner (5/-)	12/-	4/9	40	12½	6/3	..	10 0 0
Brush Ord.	4/6	1/9	Nil	Nil	4/-	..	—
Callender's	69/-	46/-	15	15	63/9	..	4 14 4
Chloride Elec. Storage	72/6	55/-	15	15	62/6	..	4 16 0
Consolidated Signal	72/6	59/-	36½	17	65/-	..	5 4 7
Crabtree (10/-)	24/9	17/6	17½	17½	22/6	..	7 15 7
Crompton Parkinson:							
Ord. (5/-)	20/-	12/-	30	20	18/9	..	5 6 8
E. K. Cole (5/-)	5/-	2/6	10	Nil	4/6	..	—
Elec. & Mutual Industries (10/-)	10/3	4/3	5	Nil	7/9	..	—
Electric Construction	36/3	27/6	13½	10	27/6	..	7 5 6
Enfield Cable Ord.	56/-	40/6	25	16½	50/-	..	6 10 0
Electrical Switchgear (10/-)	22/6	20/-	16	10	20/-	..	5 0 0
English Electric	33/9	16/6	10	10	30/-xd.	+1/3	6 13 4
Ensign Lamps (5/-)	15/3	12/6	25	25	15/-	..	8 6 3
Ericsson Tel. (5/-)	39/3	23/-	25*	25*	32/6	..	—
Ever Ready (5/-)	28/3	16/6	30	40	26/6	−6d.	7 11 0
Falk Stadelmann	18/3	12/6	6	7	14/6	..	9 13 2
Ferranti Pref.	25/-	22/-	7	7	25/-	+6d.	5 12 0
G.E.C.:							
Pref.	32/6	26/-	6½	6½	32/6	..	4 0 0
Ord.	83/3	53/3	20	20	78/9	−6d.	5 1 6
Greenwood & Batley	25/6	20/-	15	13	20/-	..	13 0 0
Hall Telephone (10/-)	18/6	8/9	15	10	11/3	..	8 18 0
Henley's (5/-)	21/6	12/6	20	20	20/-	..	5 0 0
4½% Pref.	21/2	20/6	4½	4½	21/3xd.	+6d.	4 4 8
Hopkinsons	46/9	32/6	15	15	39/6	..	7 12 0
India-Rubber Pref.	21/-	19/6	5½	5½	21/3	..	5 3 6
Intl. Combustion	121/3	70/-	32½	30	4½	..	6 6 4
J. Lucas	60/6	40/-	15	15	55/-	+⅛	5 9 1
Johnson & Phillips	50/9	32/6	12½	15	46/3	..	6 9 10
Lancashire Dynamo	59/9	47/6	25	20	52/6	..	7 12 4
Laurence Scott (5/-)	11/-	6/-	15	15	7/-	..	10 14 2
London Elec. Wire	25/6	20/-	7½	7½	22/6	..	6 13 4
Mather & Platt	46/6	30/-	13½	10	37/6	..	5 6 8
Metropolitan Elec. Cable Pf.	22/-	21/3	5½	5½	21/3	..	5 3 6
Murex	86/9	52/6	20	20	78/9	..	5 1 9
Pye Deferred (5/-)	9/-	6/9	25	25	10/-	..	14 5 8
Revo (10/-)	20/9	11/6	17½	5	20/-	..	2 10 0
Revrolle	60/6	41/-	12½	12½	50/-	..	5 0 0
Siemens Ord.	23/9	15/6	7½	7½	20/-	..	7 10 0
Strand Elec. (5/-)	2/3	9d.	4	2	1/9	..	5 14 4
S. Smith (1/-)	8/-	3/6	37½	50	7/6	..	6 13 4
Switchgear & Cowans (5/-)	11/9	5/6	20	10	8/9	..	5 14 3
Telegraph Condenser (10/-)	8/9	6/3	5	..	7/6	..	—
Telegraph Construction	42/6	29/-	10	10	36/3	..	5 10 6
Telephone Mfg. (5/-)	9/-	5/-	9	9	7/-	..	6 8 7
Tube Investments	96/9	59/-	23½	23½	90/9	..	5 5 9
Vactric (5/-)	3/6	2/-	4	Nil	2/3	..	—
Vickers (10/-)	22/-	9/6	10	10	14/9	−6d.	6 15 7
Ward & Goldstone (5/-)	19/6	12/6	20	20	13/9	..	7 5 6
Westinghouse Brake	46/-	30/6	17½	10	41/3	..	4 17 0
Walsall Conduits (4/-)	26/6	17/6	55	55	26/3	..	8 7 8
West, Allen	7/-	3/-	7½	10	3/9	..	10 0 0

*Dividends are paid free of Income Tax.

CONTRACT INFORMATION

Tenders Invited and Accepted. Schemes Promising Electrical Work

Contracts Open

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses. Further details of items marked with an asterisk can be obtained from the Department of Overseas Trade (Inquiry Room), Millbank, Westminster, London, S.W.1.

Belfast.—February 24th. Electricity Committee. AC motors and wiring to replace DC installation at consumers' premises; fitting up of electric water heating installations in consumers' premises during period from April 1st, to June 30th, 1941. Specifications, with forms of tender, from the city electrical engineer and general manager, East Bridge Street. (Deposit: £1 1s.)

Brierfield.—March 13th. Electricity Department. 300-kVA transformer, also 6,600-V metalclad switchgear. (See this issue.)

Burnley.—March 7th. Electricity Department. E.h.v. switchgear, transformers, e.h.v. cables, fuse pillars and boxes. (See this issue.)

East Grinstead.—February 24th. U.D.C. 11-kV outdoor type ring main units and 200-kVA outdoor type transformer. (February 14th.)

Manchester.—February 27th. Electricity Department. Fire extinguishing equipment for switchgear, transformers, &c. (February 7th.)

Morecambe & Heysham.—March 14th. Electricity Department. 6,000 kVA and 400 kVA indoor-type transformers. (See this issue.)

South Africa.—PRETORIA.—March 26th. City Council. Switchgear, transformers, reactors and auxiliary apparatus. (February 14th.)

April 2nd. City Council. Pipework equipment for the power station. (See this issue.)

PORT ELIZABETH.—March 13th. Municipality. One battery-driven tower wagon and one battery-driven van. (T. 15013/41.)*

Electric lamps and cable conduit. T.15014/41.)*

Southern Rhodesia.—SALISBURY.—March 10th. City Electricity Department. 374 meters of various types. (T. 23645/40)* Material for electrical distribution. (T.Y.15136/41.)*

Stores Department. March 28th. Electrically driven rendering vessel, etc., for municipal abattoir. (T.15135/41.)*

Tredegar.—March 6th. U.D.C. Surveyor's and Electricity Departments. Stores. (February 14th.)

Wolverhampton.—March 17th. Electricity Department. Paper insulated cables, compound and compounded insulating tapes. (February 7th.)

Orders Placed

Biggleswade.—U.D.C. Accepted. Centrifugal sludge pump (£242).—Pulsometer Engineering Co.

Blackpool.—Electricity Committee. Accepted. Transformers.—Lindley Thompson Transformer & Service Co. Switchgear.—Switchgear & Cowans.

Durham.—County Education Committee. Accepted. Electrical installation at additional buildings at Easington Colliery Senior Boys' and Girls' School (£528).—B. L. Oliver. Electrical installation at East Stanley School (£213), and at Flint Hill School (£96).—T. W. Atkinson.

Huddersfield. — Corporation. Accepted. Replacement of three diaphragms in turbine.—English Electric Co.

Electricity Department. Accepted. Replacement of bulbs for Marsden rectifier.—Bruce Peebles & Co.

Liverpool.—Hospitals Committee. Accepted. Electrical supplies required at various hospitals.—Baxendale & Co.; Smith & Cookson; Downes & Davies; General Electric Co.; Falk, Stadelmann & Co.; V. H. Iddon, Ltd.; British Insulated Cables; Lind & Co.; Walkers, Parker & Co.; Mersey Cable Works.

Mersey Docks and Harbour Board. Accepted. Cables.—Liverpool Electric Cable Co.

London.—Metropolitan Water Board. Accepted. Engine, generator, &c. (£1,190), two 200-kW Ruston & Hornsby Diesel generating sets (£4,790).—George Cohen Sons & Co. Cable (£581)—Aberdare Cables.

North Riding. — Education Committee. Installation of electric heating and lighting in several schools. Plans by the Education Secretary, Education Offices, Northallerton.

Northumberland.—C. C. Agricultural Committee. Accepted. Sump pumps (£215) Sun Electrical Co.

Scarborough.—Town Council. Accepted. Switchgear for substation extensions (£440).—Metropolitan-Vickers Electrical Co.

Wembley. — Town Council. Accepted. Installation of electric lighting in communal shelters.—Northmet Power Co. (508 shelters); Norwest Services, Ltd. (8 shelters).

Wolverhampton.—Electricity Committee. Contracts extended for twelve months:—House service cut-outs.—Revo Electric Co. Cubicle type switchgear.—Ferguson, Pailin. Metalclad switchgear.—A. Reyrolle & Co. Transformers—Electric Construction Co.

Contracts in Prospect

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Ashton-under-Lyne. — Hurst Hotel, Queen's Road, Hurst; W. Postlethwaite, Cotton Tree Inn, Old Street.

Becontree. — Employment exchange, Weston Road; H.M.O.W.

Birmingham.—Rest centres (107) for A.R.P. Committee; H. J. Manzoni, city engineer, Council House.

Blackburn.—Electric lift and X-ray unit, Queen's Park Hospital, for T.C.; W. Pickstone, borough surveyor, Town Hall.

Bournemouth.—Flats, 297, Belle Vue Road; Rev. H. McKee.

Carlisle.—Alterations and additions, London Road; Cavaghan & Gray, Ltd.

Cork.—Housing, Greenmount (£120,000), for T.C.; C. Harrington, town clerk, City Hall.

Cornwall.—Electric lift and adaptations at the County Isolation Hospital, for C.C.; county architect, County Hall, Truro.

Derbyshire.—Completion of school shelters programme (£60,000), for E.C.; county architect, St. Mary's Gate, Derby.

Dewsbury.—Heating apparatus in school and trench shelters, and canteen, Ravensthorpe School, for E.C.; M. H. Forward, borough architect, Town Hall.

Dublin.—Flat dwellings (16), Cook Street area, for T.C.; H. G. Simms, housing architect, 5, Wellington Quay.

Dunmow.—Design studios, Hatfield Grange, Hatfield Broad Oak; J. Crossby & Sons, Ltd.

Dunstable.—Slipper baths, for T.C.; borough surveyor, Municipal Offices, High Street North.

Gosport.—Fire centre, for B.C.; borough surveyor, Town Hall.

Hanchurch.—Sanatorium for Stoke-on-Trent T.C.; Hobson and Withington, quantity surveyors, 1A, Marsh Street, Hanley.

Hebburn-on-Tyne. — Hotel, Hedgeley Road, for McEwan & Co., Ltd. (£8,000); Page, Son and Bradbury, architects, 75, King Street, South Shields.

Hull.—Elevator, for Lee Smith, Ltd.; R. G. Clark, architect.

Ilkeston.—Bus garage & works, Manor Road & Back Lane; Barton Transport, Ltd.

Kettering.—Additions to printing works; T. Beaty Hart, Ltd., Green Lane.

Warehouse, Field Street; E. Mills & Co., Upper Field Street.

Kidderminster.—Heating, lighting and ventilation installations in infants' shelters, and shelters at Hoobrook School, for T.C.; borough surveyor, Mill Street.

Kilmarnock.—Stores, garage, canteen, &c. (£1,200), for Barr, Thomson & Co., Ltd.; the manager.

Llandudno. — Alterations, Gloddaeth Grammar School, for Caernarvonshire E.C.; W. L. Jones, county architect, Shirehall Street, Caernarvon.

Manchester.—Extensions to Parker Street bus station for T.C.; G. N. Hill, city architect, Town Hall.

Maryport.—Erection of 56 houses at Short Acres for the North-Eastern Housing Association; G. M. Pearson, builder, Houghton Road, Hetton, co. Durham.

Paisley.—Alterations to drying apparatus at works for Brown & Polson, Ltd., Royal Starch Works, Falside Road; manager.

Pendine.—Houses (80), for Carmarthen R.D.C.; Surveyor's Department, 15, Spilman Street, Carmarthen.

Pontefract.—Adaptation of premises at Pontefract Castle as mortuary for the City Council (£513); city architect.

Rotherham.—Electrical heating of school shelters for E.C.; V. Turner, borough engineer, Town Hall.

Sheffield.—Re-housing scheme for T.C.; W. G. Davies, city architect.

South Shields.—Office accommodation at New Quay, Town Dock for Tyne Improvement Commissioner; Couves and Partners, architects, Gosforth, Newcastle-on-Tyne.

Torquay.—Portion of police buildings, Torre Street; Devon county architect.

Tullamore.—Houses (82), Clontarf Road, for U.D.C.; Hoey and Denning, town clerks, Courthouse, Tullamore, Offaly.

Uttoxeter.—Houses (20), for R.D.C.; C. E. Ingham, surveyor, Market Place.

Wakefield.—Workshops, technical college (£4,000); city engineer.

Wigton.—Alterations to the Bird-in-Hand Inn; Jennings Brothers, Ltd., Castle Brewery, Cockermouth.